



**National Aeronautics and  
Space Administration  
Langley Research Center  
Scientific and Technical  
Information Program Office**

# **Scientific and Technical Aerospace Reports**

# **STAR**

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## **WHAT'S INSIDE**

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- **NASA STI Program Overview**
- **Introduction**
- **NASA STI Availability Information**
- **Table of Contents**
- **Subject Term Index**
- **Personal Author Index**

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Hanover, MD 21076-1320

# Introduction

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*STAR* subject coverage includes all aspects of aeronautics and space research and development, supporting basic and applied research, and application, as well as aerospace aspects of Earth resources, energy development, conservation, oceanography, environmental protection, urban transportation and other topics of high national priority. The listing is arranged first by 11 broad subject divisions, then within these divisions by 76 subject categories and includes two indexes: subject and author.

*STAR* includes citations to Research & Development (R&D) results reported in:

- NASA, NASA contractor, and NASA grantee reports
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The U.S. Patent and Trademark Office provides online access to full text patents and patent applications. The database includes patents back to 1976 plus some pre-1975 patents. Visit the USPTO at <http://www.uspto.gov/patft/>.

# Table of Contents

## Subject Divisions/Categories

Document citations are grouped by division and then by category, according to the NASA Scope and Coverage Category Guide.

### Aeronautics

02	Aerodynamics	1
03	Air Transportation and Safety	6
04	Aircraft Communications and Navigation	10
05	Aircraft Design, Testing and Performance	12
06	Avionics and Aircraft Instrumentation	16
07	Aircraft Propulsion and Power	17
08	Aircraft Stability and Control	18

### Astronautics

12	Astronautics (General)	20
15	Launch Vehicles and Launch Operations	22
16	Space Transportation and Safety	23
18	Spacecraft Design, Testing and Performance	26
19	Spacecraft Instrumentation and Astrionics	28
20	Spacecraft Propulsion and Power	29

## **Chemistry and Materials**

<b>23</b>	<b>Chemistry and Materials (General)</b>	<b>32</b>
<b>24</b>	<b>Composite Materials</b>	<b>35</b>
<b>25</b>	<b>Inorganic, Organic, and Physical Chemistry</b>	<b>36</b>
<b>26</b>	<b>Metals and Metallic Materials</b>	<b>51</b>
<b>27</b>	<b>Nonmetallic Materials</b>	<b>52</b>
<b>28</b>	<b>Propellants and Fuels</b>	<b>55</b>
<b>29</b>	<b>Space Processing</b>	<b>60</b>

## **Engineering**

<b>31</b>	<b>Engineering (General)</b>	<b>61</b>
<b>32</b>	<b>Communications and Radar</b>	<b>63</b>
<b>33</b>	<b>Electronics and Electrical Engineering</b>	<b>64</b>
<b>34</b>	<b>Fluid Mechanics and Thermodynamics</b>	<b>68</b>
<b>35</b>	<b>Instrumentation and Photography</b>	<b>75</b>
<b>36</b>	<b>Lasers and Masers</b>	<b>78</b>
<b>37</b>	<b>Mechanical Engineering</b>	<b>81</b>
<b>38</b>	<b>Quality Assurance and Reliability</b>	<b>82</b>
<b>39</b>	<b>Structural Mechanics</b>	<b>83</b>

## **Geosciences**

<b>42</b>	<b>Geosciences (General)</b>	<b>85</b>
-----------	------------------------------	-----------

43	Earth Resources and Remote Sensing	88
44	Energy Production and Conversion	90
45	Environment Pollution	90
46	Geophysics	96
47	Meteorology and Climatology	98
48	Oceanography	99

## **Life Sciences**

51	Life Sciences (General)	101
52	Aerospace Medicine	132
54	Man/System Technology and Life Support	137

## **Mathematical and Computer Sciences**

59	Mathematical and Computer Sciences (General)	138
60	Computer Operations and Hardware	139
61	Computer Programming and Software	140
62	Computer Systems	146
63	Cybernetics, Artificial Intelligence and Robotics	148
64	Numerical Analysis	149
65	Statistics and Probability	151
66	Systems Analysis and Operations Research	152

## **Physics**

<b>70</b>	<b>Physics (General)</b>	<b>153</b>
<b>71</b>	<b>Acoustics</b>	<b>154</b>
<b>72</b>	<b>Atomic and Molecular Physics</b>	<b>155</b>
<b>74</b>	<b>Optics</b>	<b>156</b>
<b>76</b>	<b>Solid-State Physics</b>	<b>158</b>
<b>77</b>	<b>Physics of Elementary Particles and Fields</b>	<b>161</b>

## **Social and Information Sciences**

<b>80</b>	<b>Social and Information Sciences (General)</b>	<b>163</b>
<b>81</b>	<b>Administration and Management</b>	<b>163</b>
<b>82</b>	<b>Documentation and Information Science</b>	<b>164</b>

## **Space Sciences**

<b>89</b>	<b>Astronomy</b>	<b>165</b>
<b>90</b>	<b>Astrophysics</b>	<b>171</b>
<b>91</b>	<b>Lunar and Planetary Science and Exploration</b>	<b>173</b>
<b>92</b>	<b>Solar Physics</b>	<b>179</b>

## **General**

<b>99</b>	<b>General</b>	<b>180</b>
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# Indexes

Two indexes are available. You may use the find command under the tools menu while viewing the PDF file for direct match searching on any text string. You may also select either of the two indexes provided for searching on *NASA Thesaurus* subject terms and personal author names.

**Subject Term Index**

**Personal Author Index**

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# SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

*A Biweekly Publication of the National Aeronautics and Space Administration*

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VOLUME 41, FEBRUARY 21, 2003

## 02 AERODYNAMICS

*Includes aerodynamics of flight vehicles, test bodies, airframe components and combinations, wings, and control surfaces. Also includes aerodynamics of rotors, stators, fans and other elements of turbomachinery. For related information, see also 34 Fluid Mechanics and Heat Transfer.*

**20030007706** NASA Langley Research Center, Hampton, VA USA

### **X-33 Turbulent Aeroheating Measurements and Predictions**

Hollis, Brian R., NASA Langley Research Center, USA; Berry, Scott A., NASA Langley Research Center, USA; Horvath, Thomas J., NASA Langley Research Center, USA; [2002]; 11p; In English; AIAA Atmospheric Flight Mechanics Conference and Exhibit, 5-8 Aug. 2002, Monterey, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Original contains color illustrations

Report No.(s): AIAA Paper 2002-4700; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution under U.S. Government purpose rights; Distribution under U.S. Government purpose rights

Measurements and predictions of the X-33 turbulent aeroheating environment have been performed for Mach 6, perfect-gas air conditions. The purpose of this investigation was to compare turbulent aeroheating predictions from two Navier-Stokes codes, LAURA and GASP, with each other and with experimental data in which turbulent flow was produced through either natural transition or forced transition using roughness elements. The wind tunnel testing was conducted at free stream Reynolds numbers of  $0.72 \times 10(\text{exp } 7)/\text{m}$  to  $2.4 \times 10(\text{exp } 7)/\text{m}$  ( $2.2 \times 10(\text{exp } 6)/\text{ft}$  to  $7.3 \times 10(\text{exp } 6)/\text{ft}$ ) on 0.254 m (10.0-in.) X-33 models at  $\alpha = 40$  deg with smooth surfaces, smooth surfaces with discrete trips, and surfaces with simulated bowed thermal protection system panels. Turbulent flow was produced by the discrete trips and bowed panels for all but the lowest Reynolds number, while turbulent flow on the smooth model was produced only at the highest Reynolds number. Turbulent aeroheating levels on each of the three model types were measured using global phosphor thermography and agreed to within the experimental accuracy ( $\pm 15\%$ ) of the test technique. Computations were performed at the wind tunnel free stream conditions using both codes. Turbulent aeroheating levels predicted using the LAURA code were generally 5%-10% lower than those from GASP, although both sets of predictions fell within the experimental accuracy of the wind tunnel data.

Author

*Aerodynamic Heating; Wind Tunnel Tests; Navier-Stokes Equation; Turbulent Flow; Reynolds Number; Thermography; Computer Programs; Computational Fluid Dynamics*

**20030007721** NASA Langley Research Center, Hampton, VA USA

### **Effects of Liner Geometry on Acoustic Impedance**

Jones, Michael G., NASA Langley Research Center, USA; Tracy, Maureen B., NASA Langley Research Center, USA; Watson, Willie R., NASA Langley Research Center, USA; Parrott, Tony L., NASA Langley Research Center, USA; [2002]; 10p; In English; 8th AIAA/CEAS Aeroacoustics Conference, 16-18 Jun. 2002, Breckenridge, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 2002-2446; Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; Distribution under U.S. Government purpose rights; Distribution under U.S. Government purpose rights

Current aircraft engine nacelles typically contain acoustic liners consisting of perforated sheets bonded onto honeycomb cavities. Numerous models have been developed to predict the acoustic impedance of these liners in the presence of grazing flow, and to use that information with aeroacoustic propagation codes to assess nacelle liner noise suppression. Recent efforts have provided advances in impedance education methodologies that offer more accurate determinations of acoustic liner properties in

the presence of grazing flow. The current report provides the results of a parametric study, in which a finite element method was used to assess the effects of variations of the following geometric parameters on liner impedance, with and without the presence of grazing flow: percent open area, sheet thickness, sheet thickness-to-hole diameter ratio and cavity depth. Normal incidence acoustic impedances were determined for eight acoustic liners, consisting of punched aluminum facesheets bonded to hexcell honeycomb cavities. Similar liners were tested in the NASA Langley Research Center grazing incidence tube to determine their response in the presence of grazing flow. The resultant data provide a quantitative assessment of the effects of these perforate, single-layer liner parameters on the acoustic impedance of the liner.

Author

*Acoustic Impedance; Nacelles; Aeroacoustics; Linings; Hole Geometry (Mechanics); Grazing Flow*

**20030007722** NASA Langley Research Center, Hampton, VA USA

**Development of Reduced-Order Models for Aeroelastic and Flutter Prediction Using the CFL3Dv6.0 Code**

Silva, Walter A., NASA Langley Research Center, USA; Bartels, Robert E., NASA Langley Research Center, USA; [2002]; 11p; In English; 43rd AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference, 22-25 Apr. 2002, Denver, CO, USA; Sponsored by American Society of Mechanical Engineers, USA

Report No.(s): AIAA Paper 2002-1596; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution under U.S. Government purpose rights; Distribution under U.S. Government purpose rights

A reduced-order model (ROM) is developed for aeroelastic analysis using the CFL3D version 6.0 computational fluid dynamics (CFD) code, recently developed at the NASA Langley Research Center. This latest version of the flow solver includes a deforming mesh capability, a modal structural definition for nonlinear aeroelastic analyses, and a parallelization capability that provides a significant increase in computational efficiency. Flutter results for the AGARD 445.6 Wing computed using CFL3D v6.0 are presented, including discussion of associated computational costs. Modal impulse responses of the unsteady aerodynamic system are then computed using the CFL3Dv6 code and transformed into state-space form. Important numerical issues associated with the computation of the impulse responses are presented. The unsteady aerodynamic state-space ROM is then combined with a state-space model of the structure to create an aeroelastic simulation using the MATLAB/SIMULINK environment. The MATLAB/SIMULINK ROM is used to rapidly compute aeroelastic transients including flutter. The ROM shows excellent agreement with the aeroelastic analyses computed using the CFL3Dv6.0 code directly.

Author

*Computational Fluid Dynamics; Aeroelasticity; Flutter Analysis; Prediction Analysis Techniques; Simulation*

**20030007728** NASA Langley Research Center, Hampton, VA USA

**Trailing Edge Noise Prediction Based on a New Acoustic Formulation**

Casper, J., NASA Langley Research Center, USA; Farassat, F., NASA Langley Research Center, USA; [2002]; 13p; In English; 8th AIAA/CEAS Aeroacoustics Conference and Exhibit, 17-19 Jun. 2002, Breckenridge, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 2002-2477; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution under U.S. Government purpose rights; Distribution under U.S. Government purpose rights

A new analytic result in acoustics called 'Formulation 1B,' proposed by Farassat, is used to compute broadband trailing edge noise from an unsteady surface pressure distribution on a thin airfoil in the time domain. This formulation is a new solution of the Ffowcs Williams-Hawkings equation with the loading source term, and has been shown in previous research to provide time domain predictions of broadband noise that are in excellent agreement with experiment. Furthermore, this formulation lends itself readily to rotating reference frames and statistical analysis of broadband trailing edge noise. Formulation 1B is used to calculate the far field noise radiated from the trailing edge of a NACA 0012 airfoil in low Mach number flows, using both analytical and experimental data on the airfoil surface. The results are compared to analytical results and experimental measurements that are available in the literature. Good agreement between predictions and measurements is obtained.

Author

*Trailing Edges; Noise Prediction; Aeroacoustics; Numerical Analysis*

**20030007788** NASA Langley Research Center, Hampton, VA USA

**Investigation of Aerodynamics Scale Effects for a Generic Fighter Configuration in the National Transonic Facility (Invited)**

Tomek, W. G., NASA Langley Research Center, USA; Wahls, R. A., NASA Langley Research Center, USA; Owens, L. R., NASA Langley Research Center, USA; Burner, A. B., NASA Langley Research Center, USA; Graves, S. S., NASA Langley Research Center, USA; Luckring, J. M., NASA Langley Research Center, USA; [2003]; 24p; In English; 41st AIAA Aerospace Sciences

Meeting and Exhibit, 6-9 Jan. 2003, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA  
Report No.(s): AIAA Paper 2003-0751; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Two wind tunnel tests of a generic fighter configuration have been completed in the National Transonic Facility. The primary purpose of the tests was to assess Reynolds number scale effects on a thin-wing, fighter-type configuration up to full-scale flight conditions (that is, Reynolds numbers of the order of 60 million). The tests included longitudinal and lateral/directional studies at subsonic and transonic conditions across a range of Reynolds numbers from that available in conventional wind tunnels to flight conditions. Results are presented for three Mach numbers (0.6, 0.8, and 0.9) and three configurations: 1) Fuselage / Wing, 2) Fuselage / Wing / Centerline Vertical Tail / Horizontal Tail, and 3) Fuselage / Wing / Trailing-Edge Extension / Twin Vertical Tails. Reynolds number effects on the lateral-directional aerodynamic characteristics are presented herein, along with longitudinal data demonstrating the effects of fixing the boundary layer transition location for low Reynolds number conditions. In addition, an improved model videogrammetry system and results are discussed.

Author

*Aerodynamic Characteristics; Fighter Aircraft; Thin Wings; Wind Tunnel Tests; Body-Wing Configurations; Reynolds Number; Boundary Layer Transition; Scale Effect*

**20030007789** NASA Langley Research Center, Hampton, VA USA

**Uncertainty in Computational Aerodynamics**

Luckring, J. M., NASA Langley Research Center, USA; Hemsch, M. J., NASA Langley Research Center, USA; Morrison, J. H., NASA Langley Research Center, USA; [2003]; 16p; In English; 41st AIAA Aerospace Sciences Meeting and Exhibit, 6-9 Jan. 2003, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 2003-0409; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An approach is presented to treat computational aerodynamics as a process, subject to the fundamental quality assurance principles of process control and process improvement. We consider several aspects affecting uncertainty for the computational aerodynamic process and present a set of stages to determine the level of management required to meet risk assumptions desired by the customer of the predictions.

Author

*Computational Fluid Dynamics; Quality Control; Aerodynamics*

**20030007819** NASA Langley Research Center, Hampton, VA USA

**NASA Langley Research Center Wake Vortex Research Supporting VAMS**

Rutishauser, David, NASA Langley Research Center, USA; Virtual Airspace Modeling and Simulation (VAMS) Project First Technical Interchange Meeting; Jul. 31, 2002, pp. 214-221; In English; Also announced as 20030007808; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

NASA researchers have designed a system to predict aircraft wake turbulence on final approach, so airliners can be spaced more safely and efficiently. This technology, known as the Aircraft Vortex Spacing System (AVOSS), demonstrates an integration of technologies that provides weather-dependent dynamic aircraft spacing for wake avoidance in a real-time relevant environment. AVOSS was successfully demonstrated at Dallas Fort-Worth Airport in July 2000. The demonstration represented the culmination of 6 years of field-testing, data collection, and development.

Derived from text

*Aircraft Wakes; Vortices; Turbulence; NASA Programs; Systems Engineering*

**20030007845** Michigan State Univ., Dept. of Mechanical Engineering, East Lansing, MI USA

**Computing Aerodynamic Performance of a 2D Iced Airfoil: Blocking Topology and Grid Generation**

Chi, X., Michigan State Univ., USA; Zhu, B., Michigan State Univ., USA; Shih, T. I.-P., Michigan State Univ., USA; Slater, J. W., NASA Glenn Research Center, USA; Addy, H. E., NASA Glenn Research Center, USA; Choo, Yung K., NASA Glenn Research Center, USA; January 2002; 10p; In English; 40th Aerospace Sciences Meeting and Exhibit, 14-17 Jan. 2002, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

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The ice accrued on airfoils can have enormously complicated shapes with multiple protruded horns and feathers. In this paper, several blocking topologies are proposed and evaluated on their ability to produce high-quality structured multi-block grid systems. A transition layer grid is introduced to ensure that jaggedness on the ice-surface geometry do not propagate into the

domain. This is important for grid-generation methods based on hyperbolic PDEs (Partial Differential Equations) and algebraic transfinite interpolation. A 'thick' wrap-around grid is introduced to ensure that grid lines clustered next to solid walls do not propagate as streaks of tightly packed grid lines into the interior of the domain along block boundaries. For ice shapes that are not too complicated, a method is presented for generating high-quality single-block grids. To demonstrate the usefulness of the methods developed, grids and CFD solutions were generated for two iced airfoils: the NLF0414 airfoil with and without the 623-ice shape and the B575/767 airfoil with and without the 145m-ice shape. To validate the computations, the computed lift coefficients as a function of angle of attack were compared with available experimental data. The ice shapes and the blocking topologies were prepared by NASA Glenn's SmagglIce software. The grid systems were generated by using a four-boundary method based on Hermite interpolation with controls on clustering, orthogonality next to walls, and C continuity across block boundaries. The flow was modeled by the ensemble-averaged compressible Navier-Stokes equations, closed by the shear-stress transport turbulence model in which the integration is to the wall. All solutions were generated by using the NPARC WIND code.

Author

*Aerodynamic Characteristics; Aircraft Icing; Airfoils; Topology; Grid Generation (Mathematics); Multiblock Grids*

**20030007882** NASA Langley Research Center, Hampton, VA USA

**X-29 High Alpha Test in the National Transonic Facility**

Underwood, Pamela J., Vigyan Research Associates, Inc., USA; Owens, Lewis R., NASA Langley Research Center, USA; Wahls, Richard A., NASA Langley Research Center, USA; Williams, Susan, NASA Langley Research Center, USA; [2003]; 12p; In English; 41st AIAA Aerospace Sciences Meeting and Exhibit, 6-9 Jan. 2003, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 2003-0752; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

This paper describes the X-29A research program at the National Transonic Facility. This wind tunnel test leveraged the X-29A high alpha flight test program by enabling ground-to-flight correlation studies with an emphasis on Reynolds number effects. The background and objectives of this test program, as well as the comparison of high Reynolds number wind tunnel data to X-29A flight test data are presented. The effects of Reynolds number on the forebody pressures at high angles of attack are also presented. The purpose of this paper is to document this test and serve as a reference for future ground-to-flight correlation studies, and high angle-of-attack investigations. Good ground-to-flight correlations were observed for angles of attack up to 50 deg, and Reynolds number effects were also observed.

Author

*X-29 Aircraft; Wind Tunnel Tests; Wind Tunnels; Reynolds Number; Flight Tests; Angle of Attack; Pressure Distribution*

**20030007895** NASA Langley Research Center, Hampton, VA USA

**Fractional Factorial Experiment Designs to Minimize Configuration Changes in Wind Tunnel Testing**

DeLoach, Richard, NASA Langley Research Center, USA; Cler, Daniel L., NASA Langley Research Center, USA; Graham, Albert B., Vigyan Research Associates, Inc., USA; [2002]; 27p; In English; 40th AIAA Aerospace Sciences Meeting and Exhibit, 14-17 Jan. 2002, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

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This paper serves as a tutorial to introduce the wind tunnel research community to configuration experiment designs that can satisfy resource constraints in a configuration study involving several variables, without arbitrarily eliminating any of them from the experiment initially. The special case of a configuration study featuring variables at two levels is examined in detail. This is the type of study in which each configuration variable has two natural states - 'on or off', 'deployed or not deployed', 'low or high', and so forth. The basic principles are illustrated by results obtained in configuration studies conducted in the Langley National Transonic Facility and in the ViGYAN Low Speed Tunnel in Hampton, Virginia. The crucial role of interactions among configuration variables is highlighted with an illustration of difficulties that can be encountered when they are not properly taken into account.

Author

*Wind Tunnel Tests; Wind Tunnels; Factorial Design; Mathematical Models; Wind Tunnel Models; Aerodynamic Configurations; Statistical Analysis*

**20030007917** NASA Ames Research Center, Moffett Field, CA USA

**Aerodynamic Shape Optimization Using Hybridized Differential Evolution**

Madavan, Nateri K., NASA Ames Research Center, USA; [2003]; 8p; In English; AIAA 21st Applied Aerodynamics Conference,



23-26 Jun. 2003, Orlando, FL, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA  
Contract(s)/Grant(s): RTOP 512-40-12; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

An aerodynamic shape optimization method that uses an evolutionary algorithm known as Differential Evolution (DE) in conjunction with various hybridization strategies is described. DE is a simple and robust evolutionary strategy that has been proven effective in determining the global optimum for several difficult optimization problems. Various hybridization strategies for DE are explored, including the use of neural networks as well as traditional local search methods. A Navier-Stokes solver is used to evaluate the various intermediate designs and provide inputs to the hybrid DE optimizer. The method is implemented on distributed parallel computers so that new designs can be obtained within reasonable turnaround times. Results are presented for the inverse design of a turbine airfoil from a modern jet engine. (The final paper will include at least one other aerodynamic design application). The capability of the method to search large design spaces and obtain the optimal airfoils in an automatic fashion is demonstrated.

Author

*Shape Optimization; Aerodynamic Configurations; Computational Fluid Dynamics; Algorithms*

**20030009796** NASA Langley Research Center, Hampton, VA USA

**Transonic Unsteady Aerodynamics of the F/A-18E at Conditions Promoting Abrupt Wing Stall**

Schuster, David M., NASA Langley Research Center, USA; Byrd, James E., Lockheed Martin Engineering and Sciences Co., USA; [2003]; 14p; In English; 41st Aerospace Sciences Meeting and Exhibit, 6-9 Jan. 2003, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 2003-0593; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

A transonic wind tunnel test of an 8% F/A-18E model was conducted in the NASA Langley Research Center (LaRC) 16-Foot Transonic Tunnel (16-Ft TT) to investigate the Abrupt Wing Stall (AWS) characteristics of this aircraft. During this test, both steady and unsteady measurements of balance loads, wing surface pressures, wing root bending moments, and outer wing accelerations were performed. The test was conducted with a wide range of model configurations and test conditions in an attempt to reproduce behavior indicative of the AWS phenomenon experienced on full-scale aircraft during flight tests. This paper focuses on the analysis of the unsteady data acquired during this test. Though the test apparatus was designed to be effectively rigid, model motions due to sting and balance flexibility were observed during the testing, particularly when the model was operating in the AWS flight regime. Correlation between observed aerodynamic frequencies and model structural frequencies are analyzed and presented. Significant shock motion and separated flow is observed as the aircraft pitches through the AWS region. A shock tracking strategy has been formulated to observe this phenomenon. Using this technique, the range of shock motion is readily determined as the aircraft encounters AWS conditions. Spectral analysis of the shock motion shows the frequencies at which the shock oscillates in the AWS region, and probability density function analysis of the shock location shows the propensity of the shock to take on a bi-stable and even tri-stable character in the AWS flight regime.

Author

*Aerodynamic Stalling; Stability; Transonic Wind Tunnels; Unsteady Aerodynamics; Wind Tunnel Tests; Wings; F-18 Aircraft*

**20030009800** NASA Langley Research Center, Hampton, VA USA

**A Discrete-Vortex Method for Studying the Wing Rock of Delta Wings**

Gainer, Thomas G., NASA Langley Research Center, USA; December 2002; 79p; In English

Contract(s)/Grant(s): RTOP 537-07-22-24

Report No.(s): NASA/TP-2002-211965; NAS 1.60:211965; L-17796; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

A discrete-vortex method is developed to investigate the wing rock problem associated with highly swept wings. The method uses two logarithmic vortices placed above the wing to represent the vortex flow field and uses boundary conditions based on conical flow, vortex rate of change of momentum, and other considerations to position the vortices and determine their strengths. A relationship based on the time analogy and conical-flow assumptions is used to determine the hysteretic positions of the vortices during roll oscillations. Static and dynamic vortex positions and wing rock amplitudes and frequencies calculated by using the method are generally in good agreement with available experimental data. The results verify that wing rock is caused by hysteretic deflections of the vortices and indicate that the stabilizing moments that limit wing rock amplitudes are the result of the one primary vortex moving outboard of the wing where it has little influence on the wing.

Author

*Wing Rock; Vortices; Flow Distribution; Dynamic Stability; Delta Wings; Stabilization*

**20030011360** Naval Postgraduate School, Monterey, CA USA

**Summary of Research 2000, Department of Aeronautics and Astronautics**

Platzter, Max F.; Shreeve, Raymond P.; Dec. 2001; 68p; In English

Report No.(s): AD-A408912; NPS-09-02-002; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report contains project summaries of the research projects in the Department of Aeronautics and Astronautics. A list of recent publications is also included, which consists of conference presentations and publications, books, contributions to books, published journal papers, and technical reports. Thesis abstracts of students advised by faculty in the Department are also included.

DTIC

*Aeronautics; Astronautics*

**20030011493** Arizona State Univ., Dept. of Mechanical and Aerospace Engineering, Tempe, AZ USA

**A New Approach for Prediction of Aircraft Spin Final Report, Jun. 1999-Jun 2002**

Squires, Kyle D.; Dec. 12, 2002; 53p; In English

Contract(s)/Grant(s): F49620-00-1-0050

Report No.(s): AD-A408769; XXA-0090/TE; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Unsteady Reynolds-averaged Navier-Stokes and Detached-Eddy Simulation are used to predict the flow around a forebody cross-section modeled by a rounded-corner square. The inlet velocity is inclined at 10 degrees to the main flow, the configuration modeling the massively separated flow around the forebody of a jet fighter rotating at high angle of attack. Simulations are performed at sub- and super-critical Reynolds numbers, corresponding to either laminar or turbulent boundary layer separation from the forebody. DES predictions show that following flow detachment, a chaotic and three-dimensional wake rapidly develops. The temporal evolution of the streamwise and lateral (side) forces acting on the body exhibit strong modulation due to the spanwise variation of the flow. Grid refinement deepens the structure of the resolved range of turbulent scales. Predictions using unstructured meshes are also demonstrated to be equally accurate as those on structured grids. For the super-critical flow, the pressure distribution is close to the measured values, both the streamwise and side forces are in adequate agreement with measurements, and the effect of numerical parameters are well-understood. For the sub-critical flow, DES side-force predictions do not follow the experimental measurements far enough to achieve reversal. Possible causes for the discrepancy are discussed.

DTIC

*Aerodynamic Stability; Spin Stabilization; Aircraft Spin*

### 03

## AIR TRANSPORTATION AND SAFETY

*Includes passenger and cargo air transport operations; aircraft ground operations; flight safety and hazards; and aircraft accidents. Systems and hardware specific to ground operations of aircraft and to airport construction are covered in 09 Research and Support Facilities (Air). Air traffic control is covered in 04 Aircraft Communications and Navigation. For related information see also 16 Space Transportation and Safety; and 85 Technology Utilization and Surface Transportation.*

**20030007712** Federal Aviation Administration, John A. Volpe National Transportation Systems Center, Cambridge, MA USA

**SAE ARP 866A versus ISO 9613-1/ANSI S1.26-1995: A Sensitivity Analysis Comparing Two Procedures for Adjusting As-Measured Spectra to Reference Conditions**

Reherman, C. N.; Roof, C. J.; Fleming, G. G.; May 2002; In English; This document is color dependent and/or in landscape layout.

It is currently only available on CD-ROM and in paper copy

Report No.(s): PB2003-101662; No Copyright; Avail: National Technical Information Service (NTIS)

The Society of Automotive Engineers' (SAE) Aerospace Recommended Practice (ARP) No. 866A (866A), and a procedure utilizing pure-tone absorption equations developed in support of the International Organization for Standardization's (ISO) 9613-1 and the American National Standards Institute's (ANSI) S1.26-1995, are compared and a sensitivity analysis undertaken. The ISO and ANSI equations are identical to each other. Thirteen takeoff and two approach spectra for aircraft were utilized in the analysis, as well as one takeoff, two approach, and three flyover spectra for helicopters. As-measured spectra were processed at 10 standard distances between 200 and 25,000 feet, and at five different temperature/relative humidity (RH) combinations, to generate adjusted spectra and associated LAS<sub>mx</sub> values. The focus of the study is a refined version of the ISO/ANSI adjustment procedure developed specifically for application to one-third octave-level data.

NTIS

*Sensitivity Analysis; Standardization; Automobiles; Helicopters*

**20030007808** Computer Sciences Corp., Sunnyvale, CA USA

**Virtual Airspace Modeling and Simulation (VAMS) Project First Technical Interchange Meeting**

Beard, Robert, Computer Sciences Corp., USA; Kille, Robert, Computer Sciences Corp., USA; Kirsten, Richard, Computer Sciences Corp., USA; Rigtterink, Paul, Computer Sciences Corp., USA; Sielski, Henry, Computer Sciences Corp., USA; Gratteau, Melinda F., Editor, Raytheon Information Technology and Scientific Services, USA; Virtual Airspace Modeling and Simulation (VAMS) Project First Technical Interchange Meeting; Jul. 31, 2002; 340p; In English, 21-23 May 2002, Moffett Field, CA, USA; Sponsored by NASA, USA; Also announced as 20030007809 through 20030007824

Contract(s)/Grant(s): RTOP 727-04-00

Report No.(s): NASA/CP-2002-211845; A-0208373; NAS 1.55:211845; No Copyright; Avail: CASI; A15, Hardcopy; A03, Microfiche

A three-day NASA Virtual Airspace and Modeling Project (VAMS) Technical Interchange Meeting (TIM) was held at the NASA Ames Research Center in Mountain View, CA. on May 21 through May 23, 2002. The purpose of this meeting was to share initial concept information sponsored by the VAMS Project. An overall goal of the VAMS Project is to develop validated, blended, robust and transition-able air transportation system concepts over the next five years that will achieve NASA's long-term Enterprise Aviation Capacity goals. This document describes the presentations at the TIM, their related questions and answers, and presents the TIM recommendations.

Author

*Air Transportation; Air Traffic Control; Computerized Simulation; Aircraft Models; Systems Engineering; Virtual Reality; National Airspace System*

**20030007809** NASA Ames Research Center, Moffett Field, CA USA

**Airspace Systems Program: Virtual Airspace Modeling and Simulation Project**

Jacobsen, Robert, NASA Ames Research Center, USA; Virtual Airspace Modeling and Simulation (VAMS) Project First Technical Interchange Meeting; Jul. 31, 2002, pp. 87-104; In English; Also announced as 20030007808; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

The Airspace Systems Program (ASP) has identified a set of goals based on projections of annual passenger demands. The topics of discussion include: 1) Virtual Airspace Modeling and Simulation Project (VAMS) Project Description; 2) VAMS Project Management; 3) VAMS Project Schedule; and 4) Technical Interchange Meeting (TIM). This paper is in viewgraph form.

CASI

*Simulation; Virtual Reality; Civil Aviation; National Airspace System; Aircraft Models*

**20030007810** NASA Ames Research Center, Moffett Field, CA USA

**System-Level Integrated Concepts (SLIC)**

Fong, Robert, NASA Ames Research Center, USA; Virtual Airspace Modeling and Simulation (VAMS) Project First Technical Interchange Meeting; Jul. 31, 2002, pp. 105-127; In English; Also announced as 20030007808; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

The goals of the System-Level Integrated Concepts (SLIC) are to produce, and evaluate the benefits of a unified capacity-increasing concept, and to develop technology roadmaps to layout how such a concept can be developed and implemented in the National Airspace System (NAS).

CASI

*Systems Engineering; National Airspace System; Systems Integration; Technology Utilization*

**20030007812** Metron Aviation, Inc., Herndon, VA USA

**Technologies Enabling All-Weather Maximum Capacity by 2020**

Krozel, Jimmy, Metron Aviation, Inc., USA; Virtual Airspace Modeling and Simulation (VAMS) Project First Technical Interchange Meeting; Jul. 31, 2002, pp. 143-153; In English; Also announced as 20030007808; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper presents technologies that enable all-weather maximum capabilities. The topics include: 1) Need for All-Weather Capabilities; 2) Who is the Metron Aviation Team? 3) Core Ideas; 4) Enabling Technologies; 5) Roadmaps for New Technologies, Roles and Responsibilities; 6) Metrics of Goodness; 7) Costs/Benefits Tools and Analysis; and 8) Motivation for Getting There.

CASI

*Weather; Technologies; Civil Aviation; National Airspace System*



**20030007813** Seagull Technology, Inc., CA USA

**Massive Point-to-Point and On-Demand Air Transportation System Investigation**

Sorensen, John, Seagull Technology, Inc., USA; Virtual Airspace Modeling and Simulation (VAMS) Project First Technical Interchange Meeting; Jul. 31, 2002, pp. 154-165; In English; Also announced as 20030007808; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

A Point-to-Point and On-Demand Air Transportation System Concept is presented. The topics include: 1) Concept PTP Team; 2) NAS Issues and Assumption Background; 3) Concept PTP Drivers; 4) Key Technical Challenges; 5) Core Ideas Overview; and 6) Planned Early Steps. This paper is in viewgraph form.

CASI

*Air Transportation; Systems Engineering; Automation; Technology Utilization*

**20030007816** Optimal Synthesis, Inc., Los Altos, CA USA

**Surface Operation Automation Research (SOAR)**

Cheng, Victor H. L., Optimal Synthesis, Inc., USA; Virtual Airspace Modeling and Simulation (VAMS) Project First Technical Interchange Meeting; Jul. 31, 2002, pp. 184-196; In English; Also announced as 20030007808; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

The Surface Operation Automation Research (SOAR) concept is presented. The topics include: 1) Ground-Control Automation; 2) Flight-Deck automation; 3) Operational Integration of Automation Systems; and 4) Remarks on Evaluation Metrics.

CASI

*Automatic Control; Flight Operations; Research and Development; Airspace*

**20030007821** NASA Ames Research Center, Moffett Field, CA USA

**A Suggested Approach for Producing VAMS Air Transportation System Technology Roadmaps**

Weathers, Del, NASA Ames Research Center, USA; Virtual Airspace Modeling and Simulation (VAMS) Project First Technical Interchange Meeting; Jul. 31, 2002, pp. 231-253; In English; Also announced as 20030007808; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

This viewgraph presentation provides an overview on the use of technology 'roadmaps' in order to facilitate the research development of VAMS (Virtual Airspace Modeling and Simulation). These roadmaps are to be produced by each concept team, updated annually, discussed at the technical interchange meetings (TIMs), shared among all VAMS participants, and made available electronically. These concept-specific technology roadmaps will be subsequently blended into an integrated catalog of roadmaps, technical discussions, and research recommendations. A historical example of ATM (Air Traffic Management) research and technology from 1940 to 1999 as shown in a series of 'roadmaps' is also included.

CASI

*Aircraft Approach Spacing; Applications Programs (Computers); Virtual Reality; Models; Research and Development; Computerized Simulation*

**20030007822** JDA Aviation Technology Solutions, Washington, DC USA

**Technology Roadmaps**

DelBalzo, Joseph, JDA Aviation Technology Solutions, USA; Virtual Airspace Modeling and Simulation (VAMS) Project First Technical Interchange Meeting; Jul. 31, 2002, pp. 254-261; In English; Also announced as 20030007808; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

This viewgraph presentation provides an overview for Breakout Session No. 1 The workshop participants were divided into three groups. Each group was asked to respond to the following four topics related to the creation of a 'technology roadmap' for the development of the new airspace capacity concepts: (a) what is purpose of the technology roadmap? is it a tool for decision makers? why do we need it?; (b) what should a technology roadmap contain?; (c) where do transition plans fit into the roadmap?

Author

*Virtual Reality; Computerized Simulation; Applications Programs (Computers); Aircraft Approach Spacing; Air Traffic Control; Flight Management Systems; Research and Development*

**20030007824** NASA Ames Research Center, Moffett Field, CA USA

**Technical Interchange Meeting Guidelines Breakout**

Fong, Rob, NASA Ames Research Center, USA; Virtual Airspace Modeling and Simulation (VAMS) Project First Technical Interchange Meeting; Jul. 31, 2002, pp. 299-325; In English; Also announced as 20030007808; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Along with concept developers, the Systems Evaluation and Assessment (SEA) sub-element of VAMS will develop those scenarios and metrics required for testing the new concepts that reside within the System-Level Integrated Concepts (SLIC) sub-element in the VAMS project. These concepts will come from the NRA process, space act agreements, a university group, and other NASA researchers. The emphasis of those concepts is to increase capacity while at least maintaining the current safety level. The concept providers will initially develop their own scenarios and metrics for self-evaluation. In about a year, the SEA sub-element will become responsible for conducting initial evaluations of the concepts using a common scenario and metric set. This set may derive many components from the scenarios and metrics used by the concept providers. Ultimately, the common scenario/metric set will be used to help determine the most feasible and beneficial concepts. A set of 15 questions and issues, discussed below, pertaining to the scenario and metric set, and its use for assessing concepts, was submitted by the SEA sub-element for consideration during the breakout session. The questions were divided among the three breakout groups. Each breakout group deliberated on its set of questions and provided a report on its discussion.

Author

*Air Traffic Control; Aircraft Approach Spacing; Flight Management Systems; Applications Programs (Computers); Virtual Reality; Airborne Equipment; Feasibility Analysis*

**20030007898** NASA Langley Research Center, Hampton, VA USA

**Toward a Concept of Operations for Aviation Weather Information Implementation in the Evolving National Airspace System**

McAdaragh, Raymon M., Federal Aviation Administration, USA; December 2002; 32p; In English

Contract(s)/Grant(s): RTOP 728-40-10-03

Report No.(s): NASA/TM-2002-212141; L-18253; NAS 1.15:212141; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The capacity of the National Airspace System is being stressed due to the limits of current technologies. Because of this, the FAA and NASA are working to develop new technologies to increase the system's capacity which enhancing safety. Adverse weather has been determined to be a major factor in aircraft accidents and fatalities and the FAA and NASA have developed programs to improve aviation weather information technologies and communications for system users. The Aviation Weather Information Element of the Weather Accident Prevention Project of NASA's Aviation Safety Program is currently working to develop these technologies in coordination with the FAA and industry. This paper sets forth a theoretical approach to implement these new technologies while addressing the National Airspace System (NAS) as an evolving system with Weather Information as one of its subSystems. With this approach in place, system users will be able to acquire the type of weather information that is needed based upon the type of decision-making situation and condition that is encountered. The theoretical approach addressed in this paper takes the form of a model for weather information implementation. This model addresses the use of weather information in three decision-making situations, based upon the system user's operational perspective. The model also addresses two decision-making conditions, which are based upon the need for collaboration due to the level of support offered by the weather information provided by each new product or technology. The model is proposed for use in weather information implementation in order to provide a systems approach to the NAS. Enhancements to the NAS collaborative decision-making capabilities are also suggested.

Author

*National Airspace System; Weather; Accident Prevention; Aircraft Accidents; Flight Safety*

## AIRCRAFT COMMUNICATIONS AND NAVIGATION

*Includes all modes of communication with and between aircraft; air navigation systems (satellite and ground based); and air traffic control. For related information see also 06 Avionics and Aircraft Instrumentation; 17 Space Communications; Spacecraft Communications, Command and Tracking, and 32 Communications and Radar.*

**20030007811** Federal Aviation Administration, Air Traffic Planning Div., USA

### **Air Traffic Management Concepts of Operations and Their Impact on the National Airspace System (NAS)**

MacKenzie, Wayne, Federal Aviation Administration, USA; Virtual Airspace Modeling and Simulation (VAMS) Project First Technical Interchange Meeting; Jul. 31, 2002, pp. 128-142; In English; Also announced as 20030007808; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

The topics include: 1) NAS Modernization Process; 2) ICAO ATMCP Work Program; 3) RTCA NAS Concept of Operations; and 4) Where Do We Go From Here. This paper is in viewgraph form.

CASI

*Air Traffic Control; Management Planning; National Airspace System; Flight Operations*

**20030007814** NASA Ames Research Center, Moffett Field, CA USA

### **Optimization in the National Airspace System**

Sridhar, Banavar, NASA Ames Research Center, USA; Virtual Airspace Modeling and Simulation (VAMS) Project First Technical Interchange Meeting; Jul. 31, 2002, pp. 166-174; In English; Also announced as 20030007808; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

The contents include: 1) Traffic Flow Management (TFM) Problem; and 2) Future ATM Concepts Evaluation Tool (FACET).

CASI

*National Airspace System; Optimization*

**20030007815** Metron Aviation, Inc., Herndon, VA USA

### **Capacity Improvements Through Automated Surface Traffic Control**

Capozzi, Brian, Metron Aviation, Inc., USA; Virtual Airspace Modeling and Simulation (VAMS) Project First Technical Interchange Meeting; Jul. 31, 2002, pp. 175-183; In English; Also announced as 20030007808; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

The concept of improvements through automated surface traffic control is presented.

CASI

*Air Traffic Control; Automatic Control; Technology Utilization*

**20030007817** Northrop Grumman Information Technology, Inc., Reston, VA USA

### **Centralized Terminal Operation Control (CTOC) Concept**

Fergus, John, Northrop Grumman Information Technology, Inc., USA; Virtual Airspace Modeling and Simulation (VAMS) Project First Technical Interchange Meeting; Jul. 31, 2002, pp. 197-202; In English; Also announced as 20030007808; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

The contents include: 1) Operating Domains; 2) Current Terminal Issues; 3) CTOC Concept; 4) CTOC Core Ideas; 5) CTOC Benefits/Metrics; and 6) CTOC Challenges.

CASI

*Air Traffic Control; Flight Operations; Technologies*

**20030007818** Raytheon Co., Air Traffic Management Systems, USA

### **Terminal Area Capacity Enhancement Concept (TACEC)**

Arkind, Ken, Raytheon Co., USA; Virtual Airspace Modeling and Simulation (VAMS) Project First Technical Interchange Meeting; Jul. 31, 2002, pp. 203-213; In English; Also announced as 20030007808; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

TACEC is built on the belief that the technology exists today to significantly reduce separation standards. Key elements for increasing capacity in the terminal area are the new data link which must provide secure communications and the use of the local area augmentation system.

Derived from text

*Augmentation; Terminals; Technologies; Airports*

**20030007820** NASA Ames Research Center, Moffett Field, CA USA

**Advanced Airspace Concept**

Erzberger, Heinz, NASA Ames Research Center, USA; Virtual Airspace Modeling and Simulation (VAMS) Project First Technical Interchange Meeting; Jul. 31, 2002, pp. 222-230; In English; Also announced as 20030007808; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

A general overview of the Advanced Airspace Concept (AAC) is presented. The topics include: 1) Limitations of the existing system; 2) The Advanced Airspace Concept; 3) Candidate architecture for the AAC; 4) Separation assurance and conflict avoidance system (TSAFE); and 5) Ground-Air Interactions. This paper is in viewgraph form.

CASI

*Airspace; Technology Utilization; Systems Engineering; Air Traffic Control*

**20030007823** NASA Ames Research Center, Moffett Field, CA USA

**Advanced Air Transportation Technologies (AATT) Project: Distributed Air-Ground Traffic Management**

Mogford, Richard, NASA Ames Research Center, USA; Green, Steve, NASA Ames Research Center, USA; Ballin, Mark, NASA Ames Research Center, USA; Virtual Airspace Modeling and Simulation (VAMS) Project First Technical Interchange Meeting; Jul. 31, 2002, pp. 262-284; In English; Also announced as 20030007808; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

This viewgraph presentation provides an overview of active Distributed Air Ground Traffic Management (DAG-TM) work and reported on its overall progress to date. It does not include details on the concept elements (CEs). The DAG-TM research project is defined as a concept development and definition project and no tools will be delivered. of the 14 CEs, three are being explored actively: CE-5, CE-6, and CE-11. Overviews of CE-5 (Free Maneuvering for User-Preferred Separation Assurance and Local TFM Conformance), CE-6 (En Route and Transition Trajectory Negotiation for User-Preferred Separation and Local TFM Conformance) and CE-11 (Self-Spacing for Merging and In-Trail Separation) are presented.

CASI

*Air Traffic Control; Aircraft Approach Spacing; Flight Management Systems; Research and Development; Applications Programs (Computers); Airborne Equipment*

**20030009795** NASA Langley Research Center, Hampton, VA USA

**A Method of Separation Assurance for Instrument Flight Procedures at Non-Radar Airports**

Conway, Sheila R., NASA Langley Research Center, USA; Consiglio, Maria, Institute for Computer Applications in Science and Engineering, USA; [2002]; 11p; In English; AIAA Guidance, Navigation and Control Conference and Exhibit, 5-8 Aug. 2002, Monterey, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Original contains color illustrations Report No.(s): AIAA Paper 2002-4448; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

A method to provide automated air traffic separation assurance services during approach to or departure from a non-radar, non-towered airport environment is described. The method is constrained by provision of these services without radical changes or ambitious investments in current ground-based technologies. The proposed procedures are designed to grant access to a large number of airfields that currently have no or very limited access under Instrument Flight Rules (IFR), thus increasing mobility with minimal infrastructure investment. This paper primarily addresses a low-cost option for airport and instrument approach infrastructure, but is designed to be an architecture from which a more efficient, albeit more complex, system may be developed. A functional description of the capabilities in the current NAS infrastructure is provided. Automated terminal operations and procedures are introduced. Rules of engagement and the operations are defined. Results of preliminary simulation testing are presented. Finally, application of the method to more terminal-like operations, and major research areas, including necessary piloted studies, are discussed.

Author

*Air Traffic Control; Airports; Automatic Control; Instrument Flight Rules*

**20030011412** NASA Goddard Space Flight Center, Greenbelt, MD USA

**Low Power Transceiver**

STS 107 Shuttle Press Kit: Providing 24/7 Space Science Research; Dec. 16, 2002, pp. 95; In English; Also announced as 20030011376; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

One of the FREESTAR experiments, the Low Power Transceiver (LPT) experiment is a low-power, lightweight software programmable transceiver prototype technology demonstration that is being developed by NASA as a low-cost S-band spacecraft navigation and communication device. The LPT prototype receives Global Positioning System (GPS) satellite signals for



spacecraft navigation support and provides both forward and return, low-rate data communications links to the Merritt Island (MILA) and Dryden Flight Research Facility (DFRC) ground stations and to the Tracking and Data Relay Satellite System (TDRSS). The experiment is designed to demonstrate the system's ability to do simultaneous communications and navigation, as well as multi-mode communications and reconfiguration. LPT is managed by NASA's Goddard Space Flight Center and sponsored by NASA/HQ Code M. The LPT experiment consists of one thermally conductive box containing the electronics stack, three S-band antennas and one L-band antenna. The LPT payload uses general Orbiter services, including power control, command, and telemetry provided through the HHC avionics. On-orbit, the LPT payload will be primarily operated via direct communications between LPT and ground stations (MILA, WLPS, or DFRC) and/or TDRSS, with backup command and telemetry capability provided via the hitchhiker avionics and remote Payload Operations Control Center. During operations, LPT will utilize high Sband frequencies for communications. The LPT TDRSS (and GN) forward link (uplink) frequency is 2106.40625 MHz and their TDRSS (and GN) return link (downlink) frequency is 2287.5 MHz (utilizing Left-handed Circular Polarization to work with the TDRSS MA system). Two standard switch panel switches will be utilized to prohibit inadvertent operation of the antenna. An additional inhibit will be provided through the HH avionics power relay to the LPT.

Author

*Applications Programs (Computers); Space Navigation; Transmitter Receivers; Aerospace Technology Transfer; Technology Utilization; Spaceborne Experiments; Spacecraft Guidance*

## 05

### AIRCRAFT DESIGN, TESTING AND PERFORMANCE

*Includes all stages of design of aircraft and aircraft structures and systems. Also includes aircraft testing, performance, and evaluation, and aircraft and flight simulation technology. For related information, see also 18 Spacecraft Design, Testing and Performance and 39 Structural Mechanics. For land transportation vehicles, see 85 Technology Utilization and Surface Transportation.*

**20030007725** Alabama Univ., Dept. of Mechanical and Aerospace Engineering, Huntsville, AL USA

**Unmanned Hybrid Vehicle. Volume 4 of 4: IPT 3 Final Report, 1 Mar.-30 Sep. 2002**

Pierce, Jennifer C.; Quick, Dana M.; Morris, Geof F.; Frederick, Robert A., Jr.; Sep. 27, 2002; 100p; In English

Contract(s)/Grant(s): DAAH01-01-C-R160

Report No.(s): AD-A408187; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

Aviation and ground systems must increase use of emerging and advanced technologies to remain viable in complex, future battlefield environments. Unmanned vehicles will become part of future military operations due to: the demand for immediate intelligence on the battlefield, decreasing defense budgets, increasing operational tempos, and the low tolerance for casualties by the public. This work develops and evaluates system level concepts that fulfill these overall requirements using an unmanned hybrid vehicle. The unmanned hybrid vehicle combines the attributes of an autonomous vertical takeoff and landing air vehicle and an autonomous ground vehicle. This allows fast, flexible deployment and quiet, longer duration ground missions. The assumed time of deployment is the year 2012. The study included requirements definition, concept synthesis, and down selection to three final configurations. Engineering students from the University of Alabama in Huntsville and Ecole Supeneurn des Techniques Ae'ronauUques et de Construction Automobile participated on three competing design teams. Team I developed a basic system with coaxial rotors and a fuel cell drive system. The system is one unit that can both fly and operate on the ground. Team 2 developed a separate air and ground vehicle with intermeshing rotors. The integrated ground unit is deployed and retrieved by the air system. Team 3 also developed a separate air and ground vehicle but with a single rotor system that also requires a tail rotor.

DTIC

*Pilotless Aircraft; Vertical Takeoff Aircraft; Surface Vehicles*

**20030007779** NASA Langley Research Center, Hampton, VA USA

**Development and Flight Testing of an Adaptable Vehicle Health-Monitoring Architecture**

Woodard, Stanley E., NASA Langley Research Center, USA; Coffey, Neil C., NASA Langley Research Center, USA; Gonzalez, Guillermo A., NASA Langley Research Center, USA; Woodman, Keith L., NASA Langley Research Center, USA; Weathered, Brenton W., NASA Langley Research Center, USA; Rollins, Courtney H., NASA Langley Research Center, USA; Taylor, B. Douglas, Swales Aerospace, USA; Brett, Rube R., ZIN Technologies, Inc., USA; January 2003; 34p; In English; Original contains color illustrations

Contract(s)/Grant(s): RTOP 706-61-11-01

Report No.(s): NASA/TM-2003-212139; L-18250; NAS 1.15:212139; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Development and testing of an adaptable wireless health-monitoring architecture for a vehicle fleet is presented. It has three operational levels: one or more remote data acquisition units located throughout the vehicle; a command and control unit located within the vehicle; and a terminal collection unit to collect analysis results from all vehicles. Each level is capable of performing autonomous analysis with a trained adaptable expert system. The remote data acquisition unit has an eight channel programmable digital interface that allows the user discretion for choosing type of sensors; number of sensors, sensor sampling rate, and sampling duration for each sensor. The architecture provides framework for a tributary analysis. All measurements at the lowest operational level are reduced to provide analysis results necessary to gauge changes from established baselines. These are then collected at the next level to identify any global trends or common features from the prior level. This process is repeated until the results are reduced at the highest operational level. In the framework, only analysis results are forwarded to the next level to reduce telemetry congestion. The system's remote data acquisition hardware and non-analysis software have been flight tested on the NASA Langley B757's main landing gear.

Author

*Health; Measuring Instruments; Product Development; Performance Tests; Monitors; Computer Programs*

**20030007849** NASA Langley Research Center, Hampton, VA USA

**Probabilistic Design of a Plate-Like Wing to Meet Flutter and Strength Requirements**

Stroud, W. Jefferson, NASA Langley Research Center, USA; Krishnamurthy, T., NASA Langley Research Center, USA; Mason, Brian H., NASA Langley Research Center, USA; Smith, Steven A., Army Research Lab., USA; Naser, Ahmad S., Lockheed Martin Space Operations, USA; [2002]; 13p; In English; 43rd AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference, 22-25 Apr. 2002, Denver, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Original contains color illustrations

Report No.(s): AIAA Paper 2002-1464; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

An approach is presented for carrying out reliability-based design of a metallic, plate-like wing to meet strength and flutter requirements that are given in terms of risk/reliability. The design problem is to determine the thickness distribution such that wing weight is a minimum and the probability of failure is less than a specified value. Failure is assumed to occur if either the flutter speed is less than a specified allowable or the stress caused by a pressure loading is greater than a specified allowable. Four uncertain quantities are considered: wing thickness, calculated flutter speed, allowable stress, and magnitude of a uniform pressure load. The reliability-based design optimization approach described herein starts with a design obtained using conventional deterministic design optimization with margins on the allowables. Reliability is calculated using Monte Carlo simulation with response surfaces that provide values of stresses and flutter speed. During the reliability-based design optimization, the response surfaces and move limits are coordinated to ensure accuracy of the response surfaces. Studies carried out in the paper show the relationship between reliability and weight and indicate that, for the design problem considered, increases in reliability can be obtained with modest increases in weight.

Author

*Design Optimization; Structural Design; Probability Theory; Wings; Flutter; Airfoil Profiles; Stress Analysis; Design Analysis; Loads (Forces)*

**20030007923** NASA Ames Research Center, Moffett Field, CA USA

**Piloted Simulator Investigation of Techniques to Achieve Attitude Command Response with Limited Authority Servos**

Key, David L.; Heffley, Robert K.; Jan. 2002; 68p; In English

Contract(s)/Grant(s): NAS2-14360

Report No.(s): AD-A408332; NASA-A-0207144; NASA-CR-2002-211391; USAAMCOM-TR-02-A-003; NAS 1.26:211391; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The purpose of the study was to develop generic design principles for obtaining attitude command response in moderate to aggressive maneuvers without increasing SCAS series servo authority from the existing +/- 10%. In particular, to develop a scheme that would work on the UH-60 helicopter so that it can be considered for incorporation in future upgrades. The basic math model was a UH-60A version of GENHEL. The simulation facility was the NASA-Ames Vertical Motion Simulator (VMS). Evaluation tasks were Hover, Acceleration-Deceleration, and Sidestep, as defined in ADS-33D-PRF for Degraded Visual Environment (DVE). The DVE was adjusted to provide a Usable Cue Environment (UCE) equal to two. The basic concept investigated was the extent to which the limited attitude command authority achievable by the series servo could be supplemented by a 10%/sec trim servo. The architecture used provided angular rate feedback to only the series servo, shared the attitude feedback

between the series and trim servos, and when the series servo approached saturation the attitude feedback was slowly phased out. Results show that modest use of the trim servo does improve pilot ratings, especially in and around hover. This improvement can be achieved with little degradation in response predictability during moderately aggressive maneuvers.

DTIC

*Attitude Control; UH-60A Helicopter; Controllability; Servomechanisms*

**20030007924** NASA Ames Research Center, Moffett Field, CA USA

**Airworthiness Qualification Criteria for Rotorcraft with External Sling Loads**

Key, David L.; Jan. 2002; 36p; In English

Contract(s)/Grant(s): NAS2-14360

Report No.(s): AD-A408333; NASA-A-0207144; NASA-CR-2002-211390; USAAMCOM-TR-02-A-002; No Copyright;

Avail: CASI; A03, Hardcopy; A01, Microfiche

This report presents the results of a study to develop airworthiness requirements for rotorcraft with external sling loads. The report starts with a review of the various phenomena that limit external sling load operations. Specifically discussed are the rotorcraft-load aeroservoelastic stability, load-on handling qualities, effects of automatic flight control system failure, load suspension system failure, and load stability at speed. Based on past experience and treatment of these phenomena, criteria are proposed to form a package for airworthiness qualification. The desired end objective is a set of operational flight envelopes for the rotorcraft with intended loads that can be provided to the user to guide operations in the field. The specific criteria proposed are parts of ADS-33E-PRF; MIL-F-9490D, and MIL-STD-913A all applied in the context of external sling loads. The study was performed for the Directorate of Engineering, U.S. Army Aviation and Missile Command (AMCOM), as part of the contract monitored by the Aerothermodynamics Directorate, U.S. Army AMCOM.

DTIC

*Rotary Wing Aircraft; Aircraft Reliability; Loading; Qualifications; Controllability; Aeroservoelasticity*

**20030009798** NASA Langley Research Center, Hampton, VA USA

**Modal and Impact Dynamics Analysis of an Aluminum Cylinder**

Lessard, Wendy B., NASA Langley Research Center, USA; December 2002; 24p; In English; Original contains color illustrations

Contract(s)/Grant(s): RTOP 728-50-10-01

Report No.(s): NASA/TM-2002-211964; L-18246; NAS 1.15:211964; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper presents analyses for the modal characteristics and impact response of an all-aluminum cylinder. The analyses were performed in preparation for impact tests of the cylinder at The Impact Dynamics Research Facility (IDRF) at the NASA Langley Research Center. Mode shapes and frequencies were computed using NASTRAN and compared with existing experimental data to assess the overall accuracy of the mass and stiffness of the finite element model. A series of non-linear impact analyses were then performed using MSC Dytran in which the weight distribution on the floor and the impact velocity of the cylinder were varied. The effects of impact velocity and mass on the rebound and gross deformation of the cylinder were studied in this investigation.

Author

*Impact; Cylindrical Bodies; Aluminum; Numerical Analysis; Modal Response; Impact Velocity*

**20030010519** Army Aeromedical Research Lab., Fort Rucker, AL USA

**A Comparison of AH-64D and OH-58D Pilot Attitudes Toward Glass Cockpit Crewstation Designs Final Report**

Francis, Gregory; Rash, Clarence E.; Adam, Gina E.; LeDue, Patricia A.; Archie, Stefanie L.; Nov. 2002; 81p; In English

Report No.(s): AD-A408934; USAARL-2003-02; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Computers and multifunction displays are an integral part of several current Army rotary-wing aircraft. The cockpit design with these types of systems is sometimes called the "glass cockpit." Multifunction displays and computers are also an integral part of the cockpit designs for planned future aircraft. A recent study by Rash et al. (2001) noted that aircraft with a glass cockpit design have higher accident rates than corresponding aircraft with the traditional cockpit design. This finding suggested that the details of crewstation design needed to be examined. To identify significant differences, this study assessed pilots' attitudes toward glass cockpit designs in the AH-64D Apache and OH-58D Kiowa helicopters. The study compared the opinions of pilots in these two glass cockpit designs to identify which aspects of their respective cockpits were most favorable or troublesome to the pilots. The results of the study identify which areas of cockpit design require further investigation.

DTIC

*Cockpits; Aircraft Design; Crew Workstations; Helicopters*

**20030011353** Arizona Univ., Dept. of Mathematics, Tucson, AZ USA

**Improvement in Drag and Control Characteristics of Hypersonic Vehicles Through the Use of the Nonlinear Properties of the Enveloping Plasma Final Report, 1 Mar. 1998-30 Sep. 2001**

Zakharov, V. E.; Newell, A. C.; Sep. 2001; 3p; In English

Report No.(s): AD-A408886; AFRL-SR-BL-TR-02-0148; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

When we first reported our ideas about the role of vorticity in plasma-shock interactions at 1996 Princeton AFOSR meeting, there was mixed reaction among the researchers in the field. Although some of them thought that we suggested a correct explanation of Ganguly's shock-tube experiments, others were doubtful (including Ganguly himself) and continued to believe that ionization is important for the physics involved. The past few years has seen us and other research groups (e.g. Macharet et al, Leonov et al) test our ideas, and by-now it is clear and broadly acknowledged that it is the vorticity dynamics that is the key process responsible for the shock modifications and the drag reduction at moderate Mach numbers.

DTIC

*Nonlinear Systems; Mach Number; Hypersonic Vehicles; Shock Tubes; Plasmas (Physics)*

**20030011358** Defence Science and Technology Organisation, Information Technology Div., Canberra Australia

**Reduction of Shear and Flatwise Tension Strength in F-111 Honeycomb Panels Exposed to Moisture**

Bartholomeusz, Richard A.; Aug. 2002; 24p; In English; Original contains color images

Report No.(s): AD-A408906; DSTO-TR-1331; DODA-AR-012-423; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Many of the fuselage panels and control surfaces on the Royal Australian Air Force (RAAF) F-111 aircraft are made up of bonded sandwich panels. These panels are made up of thin facings of metallic sheet that are bonded to aluminium honeycomb core. A survey of RAAF aircraft showed that these panels are susceptible to damage and deterioration through exposure to moisture. A test program was conducted to quantify the effect moisture has on the shear and flatwise tension strength of this type of panel. Coupons specimens representative of the Australian fleet were manufactured and exposed to moisture. These specimens were tested over a 6 month period and it was found that moisture dramatically reduces the strength of exposed panels.

DTIC

*Shear Strength; Honeycomb Structures; Fighter Aircraft*

**20030011451** Logistics Management Inst., McLean, VA USA

**Intelligent Collaborative Aging Aircraft Parts Support Final Report**

Calderwood, David A.; Forsley, Lawrence P.; Jordan, Robert L.; Williams, Galbraith D.; Oct. 2002; 40p; In English; Original contains color images

Report No.(s): AD-A408775; LMI-DL122T1; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Department of Defense (DoD) depot-level maintenance activities often experience delays in obtaining consumable repair and replacement parts for aging aircraft systems and components. As part of a concerted effort to reduce these delays, the Defense Logistics Agency (DLA) sought design, development, and prototyping of Intelligent Collaborative Aging Aircraft Parts Support (ICAAPS). LMI, in partnership with JWK International, explored the use of data mining and analysis techniques to improve long-range projections of depot-level maintenance requirements for the DLA-managed consumable parts. During a prototype demonstration involving standard depot-level maintenance for C-2 aircraft at the Naval Air Depot in North Island, CA, use of ICAAPS analytical tools improved the forecast accuracy for each consumable part included in the initial test sample. Consequently, continued use of ICAAPS should facilitate more timely consumable parts support and enable reductions in the number and duration of DoD depot-level maintenance delays caused by consumable parts shortages.

DTIC

*Aircraft Maintenance; Defense Program; Aircraft Parts; C-2 Aircraft*

**20030011498** Michigan Univ., Dept. of Mechanical Engineering, Ann Arbor, MI USA

**Dynamic Analysis of Adaptive Structures with Embedded Compliant Mechanisms Final Report, 1 Mar. 2000-31 Jul. 2001**

Kota, Sridhar; Jul. 2002; 41p; In English

Contract(s)/Grant(s): F49620-00-1-0178

Report No.(s): AD-A408756; AFRL-SR-AR-TR-02-0387; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A systematic method for dynamic analysis of compliant mechanisms was developed including basic formulations for natural frequencies, modes, dynamic response, and frequency characteristics. Methods for design sensitivity analysis were developed to investigate the effect of various design parameters on the dynamic performance of compliant mechanisms. A micro compliant stroke amplifier mechanism, for MEMS actuator application, is presented in this report, as a design example, to demonstrate



significant differences between static and dynamic performance of compliant mechanisms. This general-purpose methodology can be applied to adaptive structures for aerospace applications. The methodology was implemented in MATLAB with user-friendly graphical interface.

DTIC

*Dynamic Response; Composite Structures; Smart Materials*

**20030011529** Florida Univ., Dept. of Aerospace Engineering Mechanics and Engineering Science, Gainesville, FL USA  
**Innovative Local-Global Methods for Aircraft Structural Design Final Report, 1 Mar. 1999-30 Nov. 2001**

Haftka, Rafael; Feb. 2002; 5p; In English

Contract(s)/Grant(s): F49620-99-1-0026

Report No.(s): AD-A408847; AFRL-SR-BL-TR-02-0149; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Global-local design of large structures presents a great challenge to structural designers to coordinate the optimization of major structural components (wing or fuselage) with optimization of individual panel details. Moreover, the continuity of the adjacent designs in terms of their geometric and material variables presents a serious manufacturing difficulty for the large structure. The research developed methodology, computational infrastructure and algorithms with sound theoretical basis to extend industrial ad hoc approaches to the global-local design and blending of local designs. We proposed a two-level optimization approach employing genetic algorithms tailored to panel design on the lower level. Genetic algorithms involving both continuous and discrete design variables were developed for the design of composite structures. Response surface approximations to optimized panel failure loads are then used for the upper level wing or fuselage optimization. In addition, metrics for measuring continuity between adjacent panels were developed and incorporated in the optimization procedure.

DTIC

*Optimization; Wings; Structural Design; Homotopy Theory; Parallel Processing (Computers); Genetic Algorithms*

## 06

### AVIONICS AND AIRCRAFT INSTRUMENTATION

*Includes all stages of design of aircraft and aircraft structures and systems. Also includes aircraft testing, performance, and evaluation, and aircraft and flight simulation technology. For related information, see also 18 Spacecraft Design, Testing and Performance and 39 Structural Mechanics. For land transportation vehicles, see 85 Technology Utilization and Surface Transportation.*

**20030010280** NASA Marshall Space Flight Center, Huntsville, AL USA

**Automated Code Standard Checker 2002**

Trevino, Luis, NASA Marshall Space Flight Center, USA; [2002]; 7p; In English; Office of Safety and Mission Assurance Software Assurance Symposium 2002, 4-6 Sep. 2002, Berkeley Springs, WV, USA; Sponsored by NASA, USA

Contract(s)/Grant(s): CSIP02-25; Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

This paper presents viewgraphs of the Marshall Space Flight Center's automated software coding standards system.

CASI

*Applications Programs (Computers); Automatic Control; Computer Systems Programs; Software Engineering; Avionics*

**20030011522** Arizona Univ., Dept. of Aerospace and Mechanical Engineering, Tucson, AZ USA

**Pressure Transducer and Computer System Providing Instantaneous Information over a Surface and Time-Dependent Predictive Ability Final Report, 1 Mar. 2001-31 May 2002**

Wynanski, Israel; May 31, 2002; 11p; In English

Contract(s)/Grant(s): F49620-01-1-0249

Report No.(s): AD-A408830; AFRL-SR-AR-TR-02-0375; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A PSI 8400 pressure transducer system providing mean pressures almost instantaneously out of 48 ports and capable of responding to low frequency oscillations was purchased and absorbed by the laboratory in support of the various separation control investigations. An array of 64 Endevco surface mounted transducers capable of dynamic measurements of pressure oscillations were also bought together with National Instruments signal conditioner units. These were already used in monitoring pressure oscillations in a cavity that were generated by actuators used on wings of the XV-15 and V-22 models for the purpose of download

alleviation. Four powerful PC computers and a server were purchased for data acquisition and storage, as well as for LES computations supporting the experiments being carried out in the Aerodynamic Laboratories at the University of Arizona.

DTIC

*Vertical Takeoff Aircraft; Dynamic Pressure; Pressure Oscillations; Pressure Sensors*

## 07

### AIRCRAFT PROPULSION AND POWER

*Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and onboard auxiliary power plants for aircraft. For related information see also 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels, and 44 Energy Production and Conversion.*

**20030007855** NASA Glenn Research Center, Cleveland, OH USA

#### **The Effect of Variable Chord Length on Transonic Axial Rotor Performance**

Roberts, William B., NASA Glenn Research Center, USA; Suder, Kenneth L., NASA Glenn Research Center, USA; Thorp, Scott A., NASA Glenn Research Center, USA; Strazisar, Anthony J., NASA Glenn Research Center, USA; Armin, Albert, Airfoil Management Co., USA; Kassaseya, George, Airfoil Management Co., USA; Journal of Turbomachinery; July 2002; Volume 24, pp. 351-357; In English; Copyright; Avail: Issuing Activity

Aircraft fan and compressor blade leading edges suffer from atmospheric particulate erosion that reduces aerodynamic performance. Recontouring the blade leading edge region can restore blade performance. This process typically results in blades of varying chord length. The question therefore arises as to whether performance of refurbished fans and compressors could be further improved if blades of varying chord length are installed into the disk in a certain order. To investigate this issue the aerodynamic performance of a transonic compressor rotor operating with blades of varying chord length was measured in back-to-back compressor test rig entries. One half of the rotor blades were the full nominal chord length while the remaining half of the blades were cut back at the leading edge to 95% of chord length and recontoured. The rotor aerodynamic performance was measured at 100, 80, and 60% of design speed for three blade installation configurations: nominal-chord blades in half of the disk and short-chord blades in half of the disk; four alternating quadrants of nominal-chord and short-chord blades; nominal-chord and short-chord blades alternating around the disk. No significant difference in performance was found between configurations, indicating that blade chord variation is not important to aerodynamic performance above the stall chord limit if leading edges have the same shape. The stall chord limit for most civil aviation turbofan engines is between 94-96% of nominal (new) blade chord.

Author

*Compressor Blades; Compressor Rotors; Transonic Compressors; Turbofan Engines; Turbocompressors; Chords (Geometry); Test Facilities; Length*

**20030007906** NASA Glenn Research Center, Cleveland, OH USA

#### **Management of Total Pressure Recovery, Distortion and High Cycle Fatigue in Compact Air Vehicle Inlets**

Anderson, Bernhard H., NASA Glenn Research Center, USA; Baust, Henry D., Department of the Air Force, USA; Agrell, Johan, Swedish Defence Research Establishment, Sweden; December 2002; 67p; In English; Original contains color illustrations  
Contract(s)/Grant(s): RTOP 708-53-13

Report No(s): NASA/TM-2002-212000; E-13672; NAS 1.15:212000; Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

It is the purpose of this study to demonstrate the viability and economy of Response Surface Methods (RSM) and Robustness Design Concepts (RDC) to arrive at micro-secondary flow control installation designs that maintain optimal inlet performance over a range of the mission variables. These statistical design concepts were used to investigate the robustness properties of 'low unit strength' micro-effector installations. 'Low unit strength' micro-effectors are micro-vanes set at very low angles-of-incidence with very long chord lengths. They were designed to influence the near wall inlet flow over an extended streamwise distance, and their advantage lies in low total pressure loss and high effectiveness in managing engine face distortion.

Author

*Inlet Flow; Engine Design; Design Optimization; Military Aircraft; Robustness (Mathematics); Statistical Analysis; Pressure Recovery*

**20030010281** NASA Langley Research Center, Hampton, VA USA

#### **Review of Air Vitiation Effects on Scramjet Ignition and Flameholding Combustion Processes**

Pellett, G. L., NASA Langley Research Center, USA; Bruno, Claudio, Rome Univ., Italy; Chinitz, W., General Applied Science

Labs., Inc., USA; [2002]; 40p; In English; 38th AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, 7-10 Jul. 2002, Indianapolis, IN, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA  
Report No.(s): AIAA Paper 2002-3880; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

This paper offers a detailed review and analysis of more than 100 papers on the physics and chemistry of scramjet ignition and flameholding combustion processes, and the known effects of air vitiation on these processes. The paper attempts to explain vitiation effects in terms of known chemical kinetics and flame propagation phenomena. Scaling methodology is also examined, and a highly simplified Damkoehler scaling technique based on OH radical production/destruction is developed to extrapolate ground test results, affected by vitiation, to flight testing conditions. The long term goal of this effort is to help provide effective means for extrapolating ground test data to flight, and thus to reduce the time and expense of both ground and flight testing.

Author

*Combustion Physics; Flame Holders; Ignition; Supersonic Combustion Ramjet Engines; Flame Propagation*

**20030011494** Carnegie-Mellon Univ., Dept. of Mechanical Engineering, Pittsburgh, PA USA

**Workshop on Benchmark Experiments in Contact Mechanics as Applied to Gas Turbine Engines Held in West Palm Beach on 12-13 May 2002 Final Report, 1 Sep. 2001-31 Jul. 2002**

Griffin, Jerry H.; Ewins, D.; Sep. 02, 2002; 11p; In English; Prepared in cooperation with Imperial Coll. London UK

Contract(s)/Grant(s): F49620-01-1-0487

Report No.(s): AD-A408767; AFRL-SR-AR-TR-02-0380; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An international workshop on benchmarks in contact mechanics and friction damping was held on the 12th and 13th of May in conjunction with the DoD sponsored HCP Conference in West Palm Beach, FL. The workshop was organized by Dr. J.H. Griffin, a Professor at Carnegie Mellon University in Pittsburgh, and Dr. E. Ewins, a Professor at Imperial College in London. The workshop was a follow-on to a workshop held last year. Its primary purpose was to define an appropriate set of benchmarks to provide a basis for direct comparison of existing methods and procedures as well as to provide reference test cases for future methods development. A secondary objective of the Workshop was to consider ways to move forward once these benchmarks have been defined. An announcement was distributed to potential participants, refer to Appendix 1: Announcement. The workshop was attended by both European and American experts from industry, universities and government agencies - see Appendix 2: List of participants. The first attempt to hold the follow-on meeting was delayed by the events of September 11, 2001 (the meeting was to have taken place in Pittsburgh on 9/13) and as a result of the ensuing delay in rescheduling, some momentum was lost. Another feature that emerged in the period during which the benchmarking meeting was being rearranged was the idea of combining.

DTIC

*Aircraft Engines; Gas Turbines; Gas Turbine Engines*

## 08

### AIRCRAFT STABILITY AND CONTROL

*Includes flight dynamics, aircraft handling qualities; piloting; flight controls; and autopilots. For related information, see also 05 Aircraft Design, Testing and Performance and 06 Avionics and Aircraft Instrumentation.*

**20030007921** NASA Langley Research Center, Hampton, VA USA

**Free-to-Roll Analysis of Abrupt Wing Stall on Military Aircraft at Transonic Speeds**

Owens, D. Bruce, NASA Langley Research Center, USA; Capone, Francis J., NASA Langley Research Center, USA; Brandon, Jay M., NASA Langley Research Center, USA; Cunningham, Kevin, NASA Langley Research Center, USA; Chambers, Joseph R., Ball Aerospace Systems Div., USA; [2003]; 24p; In English; 41st Aerospace Sciences Meeting and Exhibit, 6-9 Jan. 2003, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 2003-0750; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

Transonic free-to-roll and static wind tunnel tests for four military aircraft - the AV-8B, the F/A-18C, the preproduction F/A-18E, and the F-16C - have been analyzed. These tests were conducted in the NASA Langley 16-Foot Transonic Tunnel as a part of the NASA/Navy/Air Force Abrupt Wing Stall Program. The objectives were to evaluate the utility of the free-to-roll test technique as a tool for predicting areas of significant uncommanded lateral motions and for gaining insight into the wing-drop and wing-rock behavior of military aircraft at transonic conditions. The analysis indicated that the free-to-roll results had good agreement with flight data on all four models. A wide range of motions - limit cycle wing rock, occasional and frequent damped

wing drop/rock and wing rock divergence - were observed. The analysis shows the effects that the static and dynamic lateral stability can have on the wing drop/rock behavior. In addition, a free-to-roll figure of merit was developed to assist in the interpretation of results and assessment of the severity of the motions.

Author

*Military Aircraft; Wind Tunnel Tests; Wind Tunnels; Aerodynamic Stalling; Flight Tests; Wing Rock; Dynamic Stability; Aircraft Models*

**20030009801** NASA Langley Research Center, Hampton, VA USA

**Flutter, Postflutter, and Control of a Supersonic Wing Section**

Marzocca, Piergiovanni, Virginia Polytechnic Inst. and State Univ., USA; Librescu, Liviu, Virginia Polytechnic Inst. and State Univ., USA; Silva, Walter A., NASA Langley Research Center, USA; Journal of Guidance, Control and Dynamics; September - October 2002; Volume 25, No. 5, pp. 962-970; In English

Contract(s)/Grant(s): NAG1-2281; NAG1-01007; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

A number of issues related to the flutter and postflutter of two-dimensional supersonic lifting surfaces are addressed. Among them there are the 1) investigation of the implications of the nonlinear unsteady aerodynamics and structural nonlinearities on the stable/unstable character of the limit cycle and 2) study of the implications of the incorporation of a control capability on both the flutter boundary and the postflutter behavior. To this end, a powerful methodology based on the Lyapunov first quantity is implemented. Such a treatment of the problem enables one to get a better understanding of the various factors involved in the nonlinear aeroelastic problem, including the stable and unstable limit cycle. In addition, it constitutes a first step toward a more general investigation of nonlinear aeroelastic phenomena of three-dimensional lifting surfaces.

Author

*Unsteady Aerodynamics; Wings; Supersonic Flutter; Aeroelasticity; Mathematical Models; Active Control*

**20030010279** NASA Langley Research Center, Hampton, VA USA

**Historical Review of Uncommanded Lateral-Directional Motions at Transonic Conditions**

Chambers, Joseph R., Ball Aerospace Systems Div., USA; Hall, Robert M., NASA Langley Research Center, USA; [2003]; 24p; In English; 41st Aerospace Sciences Meeting and Exhibit, 6-9 Jan. 2003, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): F33657-96-D-2007

Report No.(s): AIAA Paper 2003-0590; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

This paper presents the results of a survey of past experiences with uncommanded lateral-directional motions at transonic speeds during specific military aircraft programs. The effort was undertaken to provide qualitative and quantitative information on past airplane programs that might be of use to the participants in the joint NASA/Navy/Air Force Abrupt Wing Stall (AWS) Program. The AWS Program was initiated because of the experiences of the F/A-18E/F development program, during which unexpected, severe wing-drop motions were encountered by preproduction aircraft at transonic conditions. These motions were judged to be significantly degrading to the primary mission requirements of the aircraft. Although the problem was subsequently solved for the production version of the F/A-18E/F, a high-level review panel emphasized the poor understanding of such phenomena and issued a strong recommendation to: "Initiate a national research effort to thoroughly and systematically study the wing drop phenomena." A comprehensive, cooperative NASA/Navy/Air Force AWS Program was designed to respond to provide the required technology requirements. As part of the AWS Program, a work element was directed at a historical review of wing-drop experiences in past aircraft development programs at high subsonic and transonic speeds. In particular, information was requested regarding: specific aircraft configurations that exhibited uncommanded motions and the nature of the motions; geometric characteristics of the air-planes; flight conditions involved in occurrences; relevant data, including wind-tunnel, computational, and flight sources; figures of merit used for analyses; and approaches used to alleviate the problem. An attempt was also made to summarize some of the more important lessons learned from past experiences, and to recommend specific research efforts. In addition to providing technical information to assist the AWS research objectives, the study produced fundamental information regarding the historical challenge of uncommanded lateral-directional motions at transonic conditions and the associated aerodynamic phenomena.

Author

*Lateral Control; Wind Tunnels; Transonic Speed; Aircraft Maneuvers; Aircraft Configurations; Flight Tests; Directional Control*



## 12 ASTRONAUTICS (GENERAL)

*Includes general research topics related to space flight and manned and unmanned space vehicles, platforms or objects launched into, or assembled in, outer space; and related components and equipment. Also includes manufacturing and maintenance of such vehicles or platforms. For specific topics in astronautics see categories 13 through 20. For extraterrestrial exploration, see 91 Lunar and Planetary Science and Exploration.*

**20030010491** Air War Coll., Maxwell AFB, AL USA

**The Command of Space: A National Vision for American Prosperity and Security**

Mar. 2000; 183p; In English; Original contains color images

Report No.(s): AD-A408743; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

This paper develops a compelling case for a national space vision to advance the American vital interests of prosperity and security. The first half of paper focuses on laying the background for the vision that follows in the second half. In the title, prosperity is listed before security since it is the reason for exploration and eventually requires protection. The paper begins with the premise that space is becoming an information center of gravity that is increasingly important to the commercial sector as well as the military. However, a major stumbling block in this transition is the lack of the means to protect on-orbit space systems. Without this capability, true command of space is not possible. The paper then transitions to a discourse on the current dependence on space in America. Next, the quest for wealth and information by the European powers in the second millennium is discussed. Each of these examples demonstrates a recurring cycle in their quest: knowledge, exploitation, investment, consumption and protection. This same cycle is seen in the early days of space where the focus was almost exclusively on knowledge and exploration. Several who possessed a vision to advance space were Jules Verne, Wernher von Braun and Arthur C. Clark. From the early days of space, the transition is made to reviewing a current focus on investment and consumption. To make the case for protecting space assets, the role of the U.S. Navy in protecting maritime commerce is examined as well as the current threat to the space sector.

DTIC

*Protection; Security; Aerospace Systems; Information Resources Management*

**20030011376** NASA, Washington, DC USA

**STS 107 Shuttle Press Kit: Providing 24/7 Space Science Research**

Dec. 16, 2002; 157p; In English; Also announced as 20030011377 through 20030011421; Original contains color illustrations; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

Space shuttle mission STS-107, the 28th flight of the space shuttle Columbia and the 113th shuttle mission to date, will give more than 70 international scientists access to both the microgravity environment of space and a set of seven human researchers for 16 uninterrupted days. Columbia's 16-day mission is dedicated to a mixed complement of competitively selected and commercially sponsored research in the space, life and physical sciences. An international crew of seven, including the first Israeli astronaut, will work 24 hours a day in two alternating shifts to carry out experiments in the areas of astronaut health and safety; advanced technology development; and Earth and space sciences. When Columbia is launched from Kennedy Space Center's Launch Pad 39A it will carry a SPACEHAB Research Double Module (RDM) in its payload bay. The RDM is a pressurized environment that is accessible to the crew while in orbit via a tunnel from the shuttle's middeck. Together, the RDM and the middeck will accommodate the majority of the mission's payloads/experiments. STS-107 marks the first flight of the RDM, though SPACEHAB Modules and Cargo Carriers have flown on 17 previous space shuttle missions. Astronaut Rick Husband (Colonel, USAF) will command STS-107 and will be joined on Columbia's flight deck by pilot William 'Willie' McCool (Commander, USN). Columbia will be crewed by Mission Specialist 2 (Flight Engineer) Kalpana Chawla (Ph.D.), Mission Specialist 3 (Payload Commander) Michael Anderson (Lieutenant Colonel, USAF), Mission Specialist 1 David Brown (Captain, USN), Mission Specialist 4 Laurel Clark (Commander, USN) and Payload Specialist 1 Ilan Ramon (Colonel, Israeli Air Force), the first Israeli astronaut. STS-107 marks Husband's second flight into space - he served as pilot during STS-96, a 10-day mission that saw the first shuttle docking with the International Space Station. Husband served as Chief of Safety for the Astronaut Office until his selection to command the STS-107 crew. Anderson and Chawla will also be making their second spaceflights. Anderson first flew on STS-89 in January 1998 (the eighth Shuttle-Mir docking mission) while Chawla flew on STS-87 in November 1997 (the fourth U.S. Microgravity Payload flight). McCool, Brown, Clark and Ramon will be making their first flights into space.

Author

*Space Shuttle Missions; Spaceborne Experiments; Columbia (Orbiter); Aerospace Sciences; Life Sciences; Space Shuttle Payloads; Microgravity; Flight Crews; Astronauts*

**20030011377** NASA, Washington, DC USA

**Mission Overview STS-107: Providing 24/7 Space Science Research**

STS 107 Shuttle Press Kit: Providing 24/7 Space Science Research; Dec. 16, 2002, pp. 1-8; In English; Also announced as 20030011376; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche

Columbia's 16-day mission is dedicated to a mixed complement of competitively selected and commercially sponsored research in the space, life and physical sciences. An international crew of seven, including the first Israeli astronaut, will work 24 hours a day in two alternating shifts to carry out experiments in the areas of astronaut health and safety; advanced technology development; and Earth and space sciences.

Derived from text

*Space Transportation System; Columbia (Orbiter); Research and Development; Aerospace Sciences; NASA Space Programs*

**20030011378** NASA, Washington, DC USA

**Summary Timeline**

STS 107 Shuttle Press Kit: Providing 24/7 Space Science Research; Dec. 16, 2002, pp. 9-16; In English; Also announced as 20030011376; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche

A brief outline of what each STS-107 crewmember will be doing on any given Flight Day during their mission is presented. Details on the various experiments are listed by acronym.

Derived from text

*Space Transportation System; Space Missions; Spaceborne Experiments; Space Shuttle Missions*

**20030011379** NASA, Washington, DC USA

**Mission Profile**

STS 107 Shuttle Press Kit: Providing 24/7 Space Science Research; Dec. 16, 2002, pp. 17-18; In English; Also announced as 20030011376; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The mission profile of the STS-107 Space Shuttle Mission is presented. A list of the seven crewmembers, the launch site, and abort landing sites for the Space Shuttle Columbia are also given.

CASI

*Space Missions; Space Transportation System; Manned Space Flight; Space Shuttles*

**20030011380** NASA, Washington, DC USA

**Crewmembers**

STS 107 Shuttle Press Kit: Providing 24/7 Space Science Research; Dec. 16, 2002, pp. 19-25; In English; Also announced as 20030011376; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche

Biographical data and educational background on each crewmember aboard the STS-107 Space Shuttle Mission is presented.

CASI

*Space Missions; Spacecrews; Space Transportation System; Space Shuttles*

**20030011381** NASA, Washington, DC USA

**Payloads: SPACEHAB Research Double Module (RDM)**

STS 107 Shuttle Press Kit: Providing 24/7 Space Science Research; Dec. 16, 2002, pp. 26-31; In English; Also announced as 20030011376; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy; A02, Microfiche

SPACEHAB Inc.'s Research Double Module (RDM) is making its first flight on STS-107. The RDM is a pressurized aluminum habitat that is carried in the space shuttle's cargo bay to expand working space aboard the shuttle. The RDM is connected to the shuttle middeck by a pressurized access tunnel. Boeing-Huntsville performed the RDM's systems integration for SPACEHAB and serves as the company's mission integration contractor. SPACEHAB Single Modules outfitted for research or logistics and Double Modules outfitted for logistics have flown on 15 space shuttle missions to date.

Derived from text

*Spacecraft Modules; Space Shuttle Payloads; Space Shuttle Missions; Logistics*

**20030011382** NASA, Washington, DC USA

**STS-107 Master Experiment List**

STS 107 Shuttle Press Kit: Providing 24/7 Space Science Research; Dec. 16, 2002, pp. 32-33; In English; Also announced as 20030011376

Report No.(s): NASA/FS-2002-06-108-MSFC; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

A master list of the various experiments conducted aboard the STS-107 Space Mission is presented. The topics include: 1) Biology; 2) Earth and Space Sciences; 3) Physical Sciences; 4) Space Product Development; and 6) Technology Development. CASI

*Space Missions; Space Transportation System; Spaceborne Experiments; Research and Development*

**20030011421** NASA, Washington, DC USA

**Shuttle Reference Data**

STS 107 Shuttle Press Kit: Providing 24/7 Space Science Research; Dec. 16, 2002, pp. 125-142; In English; Also announced as 20030011376; No Copyright; Avail: CASI; A03, Hardcopy; A02, Microfiche

This collection of shuttle reference data contains the following information: shuttle abort history, shuttle abort modes, abort decisions, space shuttle rendezvous maneuvers, space shuttle main engines, space shuttle solid rocket boosters, hold-down posts, SRB (solid rocket boosters) ignition, electrical power distribution, hydraulic power units, thrust vector control, SBR rate gyro assemblies, SBR separation and Space Shuttle Super Super Light Weight Tank (SLWT).

CASI

*Spacecraft Equipment; Space Shuttle Boosters; Thrust Vector Control; Spacecraft Instruments; Aborted Missions*

**15**

**LAUNCH VEHICLES AND LAUNCH OPERATIONS**

*Includes all classes of launch vehicles, launch/space vehicle systems, and boosters; and launch operations. For related information see also 18 Spacecraft Design, Testing, and Performance; and 20 Spacecraft Propulsion and Power.*

**20030007859** NASA Goddard Space Flight Center, Greenbelt, MD USA

**The IRIS-GUS Shuttle Borne Upper Stage System**

Tooley, Craig, NASA Goddard Space Flight Center, USA; Houghton, Martin, NASA Goddard Space Flight Center, USA; Bussolino, Luigi, Alenia Spazio S.p.A., Italy; Connors, Paul, Swales Aerospace, USA; [2002]; 9p; In English; AIAA/ASME/SAE/ASEE Joint Propulsion Conference, 8 Jul. 2002, Indianapolis, IN, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 2002-3761; Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

This paper describes the Italian Research Interim Stage - Gyroscopic Upper Stage (IRIS-GUS) upper stage system that will be used to launch NASA's Triana Observatory from the Space Shuttle. Triana is a pathfinder earth science mission being executed on rapid schedule and small budget, therefore the mission's upper stage solution had to be a system that could be fielded quickly at relatively low cost and risk. The building of the IRIS-GUS system was necessary because NASA lost the capability to launch moderately sized upper stage missions from the Space Shuttle when the PAM-D system was retired. The IRIS-GUS system restores this capability. The resulting system is a hybrid which mates the existing, flight proven IRIS (Italian Research Interim Stage) airborne support equipment to a new upper stage, the Gyroscopic Upper Stage (GUS) built by the GSFC for Triana. Although a new system, the GUS exploits flight proven hardware and design approaches in most subsystems, in some cases implementing proven design approaches with state-of-the-art electronics. This paper describes the IRIS-GUS upper stage system elements, performance capabilities, and payload interfaces.

Author

*Payloads; Launching; Earth Sciences; Airborne Equipment; Upper Stage Rocket Engines*

**20030011312** Air Force Research Lab., Propulsion Directorate West, Edwards AFB, CA USA

**Laser-Powered, Vertical Flight Experiments at the High Energy Laser System Test Facility**

Mead, Franklin B., Jr.; Larson, C. W.; Jul. 02, 2001; 19p; In English; Pres. at AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit (36th). Held in Salt Lake City, UT, 8-11 Jul 2001. Report includes viewgraphs

Contract(s)/Grant(s): AF Proj. 4847

Report No.(s): AD-A408681; AFRL-PR-ED-TP-2001-157; AIAA Paper 2001-3661; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In 1996, the Air Force Research Laboratory's Propulsion Division at Edwards AFB initiated the Lightcraft Technology Demonstration (LTD) Program that had as its main objective to launch a laser-propelled vehicle into a suborbital trajectory within a period of 5 years. The concept is a nanosatellite in which the laser propulsion engine and satellite hardware are intimately shared.

DTIC

*Launching; Nanosatellites; High Power Lasers; Laser Propulsion; Propulsion*

## 16

### SPACE TRANSPORTATION AND SAFETY

*Includes passenger and cargo space transportation, e.g., shuttle operations; and space rescue techniques. For related information, see also 03 Air Transportation and Safety and 15 Launch Vehicles and Launch Vehicles, and 18 Spacecraft Design, Testing and Performance. For space suits, see 54 Man/System Technology and Life Support.*

**20030007709** NASA Marshall Space Flight Center, Huntsville, AL USA

#### **Tethers as Debris: Hydrocode Simulation of Impacts of Tether Fragments on Planar Aerospace Materials**

Evans, Steven W., NASA Marshall Space Flight Center, USA; [2002]; 7p; In English; World Space Congress 2002, 10-19 Oct. 2002, Houston, TX, USA; Original contains color illustrations

Contract(s)/Grant(s): RTOP 279-02-14; Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; Distribution under U.S. Government purpose rights; Distribution under U.S. Government purpose rights

Tethers promise to find use in a variety of space applications. Despite being narrow objects, their great lengths result in them having large total areas, and so tethers are quite susceptible to being severed by orbital debris. Extensive work has been done designing tethers that resist severs by small debris objects, and hence have longer working lives. It is from this perspective that most recent work has considered the tether - debris question. The potential of intact tethers, or severed tether fragments, as debris to pose a significant collision risk to other spacecraft has been less well studied. Understanding the consequences of such encounters is important in assessing the risks to other spacecraft posed by tethers. In this paper I discuss the damage that two types of tethers may produce on planar aerospace materials, as revealed by hyper-velocity impact simulations using the SPHC hydrodynamic code. Tether types considered include a single nylon line and a complex design including metal wires. Target materials considered include the aluminum plates typically used in debris shielding, and solar panels.

Author

*Tetherlines; Space Debris; Damage Assessment; Impact Damage; Spacecraft Construction Materials; Hydrodynamics; Computer Programs*

**20030007778** NASA Johnson Space Center, Houston, TX USA

#### **Flight Day 2 Highlights**

Jan. 17, 2003; In English; 22 min., 29 sec. playing time, in color, with sound

Report No.(s): BRF-1437B; NONP-NASA-VT-2003007322; No Copyright; Avail: CASI; B02, Videotape-Beta; V02, Videotape-VHS

The STS-107 second flight day begins with a shot of the Spacehab Research Double Module. Live presentations of experiments underway inside of the Spacehab Module are presented. Six experiments are shown. As part of the Space Technology and Research Student Payload, students from Australia, China, Israel, Japan, New York, and Liechtenstein are studying the effect that microgravity has on ants, spiders, silkworms, fish, bees, granular materials, and crystals. Mission Specialist Kalpana Chawla is seen working with the zeolite crystal growth experiment.

CASI

*Space Transportation System; Spacecraft Modules; Microgravity; Spaceborne Experiments*

**20030007905** NASA Johnson Space Center, Houston, TX USA

#### **STS-107 Flight Day 3 Highlights**

Jan. 18, 2003; In English; 27 min. playing time, in color, with sound

Report No.(s): BRF-1437C; NONP-NASA-VT-2003007321; No Copyright; Avail: CASI; B02, Videotape-Beta; V02, Videotape-VHS

The STS-107 third flight day begins with a presentation of some of the experiments inside the SPACEHAB Research Double Module aboard the Space Shuttle Columbia. STS-107 Mission Specialist Laurel Clark is shown working with the Bioreactor Experiment. The purpose of this experiment is to grow larger cells in space. She is shown performing an analysis of the concentrate of the media used to feed these cells. Mike Anderson is shown performing measurements on breathing. Payload Specialist Iian



Ramon, Mission Specialist Kalpana Chawla, Commander Rick Husband, and Mission Specialist Laurel Clark talk with the media about the progress of these scientific experiments in space.

CASI

*Space Shuttles; Space Transportation System; Spacecraft Modules; Spaceborne Experiments; Columbia (Orbiter)*

**20030010289** NASA Johnson Space Center, Houston, TX USA

**STS-107 Flight Day 8 Highlights**

Jan. 23, 2003; In English; 23 min. playing time, in color, with sound

Report No.(s): BRF-1437H; NONP-NASA-VT-2003009293; No Copyright; Avail: CASI; B02, Videotape-Beta; V02, Videotape-VHS

This video shows the activities of the STS-107 crew (Rick Husband, Commander; William McCool, Pilot; Kalpana Chawla, David Brown, Michael Anderson, Laurel Clark, Mission Specialists; Ilan Ramon, Payload Specialist) during flight day 8 of the Columbia orbiter's final flight. The primary activities of flight day 8 are spaceborne experiments. Some background information is given on the SOFBALL (Structure of Flame Balls at Low Lewis-Number) microgravity experiment as footage of the flame balls is shown. The video also shows the MEIDEX (Mediterranean Israeli Dust Experiment) calibrating on the Moon. The six STARS (Space Technology and Research Students) international student experiments are profiled, including experiments on carpenter bees (Liechtenstein), spiders (Australia), silkworms (China), ants (USA), crystal growth (Israel), and fish embryos (Japan). A commercial experiment on roses is also profiled. Astronaut Clark gives a tour of the SpaceHab RDM (Research Double Module), in the space shuttle's payload bay. Astronauts McCool and Ramon take turns on an exercise machine. The video includes a partly cloudy view of the Pacific Ocean.

CASI

*Columbia (Orbiter); Spacecrews; Spaceborne Experiments; Spacecraft Modules*

**20030010292** NASA Johnson Space Center, Houston, TX USA

**STS-107 Flight Day 7 Highlights**

Jan. 22, 2003; In English; 13 min. playing time, in color, with sound

Report No.(s): BRF-1437G; NONP-NASA-VT-2003009373; No Copyright; Avail: CASI; B01, Videotape-Beta; V01, Videotape-VHS

This video shows the activities of the STS-107 crew (Rick Husband, Commander; William McCool, Pilot; Kalpana Chawla, David Brown, Michael Anderson, Laurel Clark, Mission Specialists; Ilan Ramon, Payload Specialist) during flight day 7 of the Columbia orbiter's final flight. The primary activities of flight day 7 are setting up and conducting spaceborne experiments in the SpaceHab RDM (Research Double Module) in the orbiter's payload bay. Silkworms and ants from the STARS (Space Technology and Research Students) international student experiments are shown. Footage of the Mediterranean Sea taken by the MEIDEX (Mediterranean Israeli Dust Experiment) is also shown. Canisters containing experiments attached to the SpaceHab RDM are shown in the space shuttle's payload bay. Other views include the Earth's surface, and the Earth's atmosphere, visible along its limb.

CASI

*Columbia (Orbiter); Spacecrews; Spaceborne Experiments; Spacecraft Modules*

**20030010296** NASA Johnson Space Center, Houston, TX USA

**STS-107 Flight Day 9 Highlights**

Jan. 24, 2003; In English; 18 min., 25 sec. playing time, in color, with sound

Report No.(s): BRF-1437I; NONP-NASA-VT-2003010428; No Copyright; Avail: CASI; B02, Videotape-Beta; V02, Videotape-VHS

This video shows the activities of the STS-107 crew (Rick Husband, Commander; William McCool, Pilot; Kalpana Chawla, David Brown, Michael Anderson, Laurel Clark, Mission Specialists; Ilan Ramon, Payload Specialist) during flight day 9 of the Columbia orbiter's final flight. The primary activities of flight day 9 are spaceborne experiments. The video shows a commercial experiment on roses, a partial view of Africa from Libya to the Horn of Africa through the MEIDEX (Mediterranean Israeli Dust Experiment), and the FAST (Facility for Absorption and Surface Tension) experiment. The STARS (Space Technology and Research Students) international student experiments are shown. The preliminary results of these experiments on the effects of microgravity on silkworms, spiders, crystal growth, fish embryos, carpenter bees, and ants are discussed. The video includes a view of southern Spain and the Mediterranean Sea.

CASI

*Columbia (Orbiter); Spacecrews; Spaceborne Experiments; Microgravity Applications; Students*

**20030010370** NASA Johnson Space Center, Houston, TX USA

**STS-107 Flight Day 5 Highlights**

Jan. 20, 2003; In English; 12 min., 30 sec. playing time, in color, with sound

Report No.(s): BRF-1437E; NONP-NASA-VT-2003007324; No Copyright; Avail: CASI; B01, Videotape-Beta; V01, Videotape-VHS

The fifth day of the STS-107 space mission begins with a presentation of The Six Space Technology and Research Students (STARS) program experiments aboard the Space Shuttle Columbia. Students from Australia, China, Israel, Japan, Lichtenstein and The USA send scientific experiments into space. The video includes the progress of experiments with various insects including silkworms, carpenter bees, ants, fish, and spiders.

CASI

*Space Missions; Space Transportation System; Columbia (Orbiter); Spaceborne Experiments; Microgravity*

**20030010441** NASA Johnson Space Center, Houston, TX USA

**STS-107 Flight Day 4 Highlights**

Jan. 19, 2003; In English; 23 min., 10 sec. playing time, in color, with sound

Report No.(s): BRF-1437D; NONP-NASA-VT-2003007323; No Copyright; Avail: CASI; B02, Videotape-Beta; V02, Videotape-VHS

This fourth flight day of the STS-107 mission begins with a view of the moon from a camera inside of the payload bay of the Space Shuttle Columbia. Presentations of the scientific experiments inside the Spacehab double module are presented. Mission Specialist Michael Anderson is shown working on the combustion module 2, Mission Specialist Kalpana Chawla is shown performing a soot test, Payload Specialist Ilan Ramon is working on the Mediterranean Israeli Dust Experiment (MEIDEX), and Commander Rick Husband is shown studying the mechanics of granular materials. A panoramic view of the pass over Saudi Arabia and the Persian Gulf are shown.

CASI

*Space Transportation System; Columbia (Orbiter); Spacecraft Modules; Space Shuttle Missions*

**20030011461** NASA Johnson Space Center, Houston, TX USA

**STS-107 Flight Day 12 Highlights**

Jan. 27, 2003; In English; 30 min., 10 sec. playing time, in color, with sound

Report No.(s): BRF-1437L; NONP-NASA-VT-2003010522; No Copyright; Avail: CASI; B03, Videotape-Beta; V03, Videotape-VHS

This video shows the activities of the STS-107 crew (Rick Husband, Commander; William McCool, Pilot; Kalpana Chawla, David Brown, Michael Anderson, Laurel Clark, Mission Specialists; Ilan Ramon, Payload Specialist) during flight day 12 of the Columbia orbiter's final mission. The primary activities are spaceborne experiments in the SpaceHab RDM (Research Double Module). Experiments shown in the video include SOFBALL (Structure of Flame Balls at Low Lewis-Number), an experiment to grow cancer cells in microgravity, and the STARS (Space Technology and Research Students) experiments, including bees, ants, chemical gardens, fish, and spiders. Crew Members are shown working on MIST (Water Mist Fire Suppression), a commercial experiment. Red Team crew members (Husband, Chawla, Clark, Ramon) are shown conversing through a handset with the Expedition 6 crew (Kenneth Bowersox, Commander; Donald Pettit, Nikolai Budarin; Flight Engineers) of the ISS (International Space Station).

CASI

*Columbia (Orbiter); Spacecrews; Spaceborne Experiments; Spacecraft Modules*

**20030011462** NASA Johnson Space Center, Houston, TX USA

**STS-107 Flight Day 10 Highlights**

Jan. 25, 2003; In English; 26 min., 30 sec. playing time, in color, with sound

Report No.(s): BRF-1437J; NONP-NASA-VT-2003010501; No Copyright; Avail: CASI; B02, Videotape-Beta; V02, Videotape-VHS

This video shows the activities of the STS-107 crew (Rick Husband, Commander; William McCool, Pilot; Kalpana Chawla, David Brown, Michael Anderson, Laurel Clark, Mission Specialists; Ilan Ramon, Payload Specialist) during flight day 10 of the Columbia orbiter's final mission. Flight day 10 includes an interview by Mission Control of astronauts Brown, McCool, and Anderson, who answer questions on the mission's spaceborne experiments, as well as biographical and other questions. Much of the video is shot and narrated by Payload Specialist Ramon, who shows the crew members at work on experiments in the SpaceHab RDM (Research Double Module), and performing other tasks. Experiments featured in the video include SOFBALL

(Structure of Flame Balls at Low Lewis-Number), the STARS (Space Technology and Research Students) experiments, and experiments on cancer and osteoporosis. Crew activities shown include making a video of Earth, and preparing for sleep. Earth views shown in the video include the Gulf of Aden, Ghana, Lake Chad, and the coast of North Carolina.

CASI

*Columbia (Orbiter); Spacecrews; Intravehicular Activity; Spaceborne Experiments; Spacecraft Modules*

**20030011463** NASA Johnson Space Center, Houston, TX USA

**STS-107 Flight Day 11 Highlights**

Jan. 26, 2003; In English; 21 min., 36 sec. playing time, in color, with sound

Report No.(s): BRF-1437K; NONP-NASA-VT-2003010430; No Copyright; Avail: CASI; B02, Videotape-Beta; V02, Videotape-VHS

This video shows the activities of the STS-107 crew (Rick Husband, Commander; William McCool, Pilot; Kalpana Chawla, David Brown, Michael Anderson, Laurel Clark, Mission Specialists; Ilan Ramon, Payload Specialist) during flight day 11 of the Columbia orbiter's final mission. In the video, crew members from the Blue Team (McCool, Brown, Anderson) and the Red Team (Husband, Chawla, Clark, Ramon) are shown at work on experiments in the SpaceHab RDM (Research Double Module), and performing other tasks. Much of the video is shot and narrated by Commander Husband. Mission Specialist Brown is shown operating the MEIDEX (Mediterranean Israeli Dust Experiment). Crew activities shown include making breakfast, entering sleep stations, and programming shuttle maneuvers necessary for the spaceborne experiments onboard. Earth views shown in the video include one of Egypt, Israel and Jerusalem.

CASI

*Columbia (Orbiter); Spacecrews; Spacecraft Modules; Spaceborne Experiments; Intravehicular Activity*

## 18

### SPACECRAFT DESIGN, TESTING AND PERFORMANCE

*Includes satellites; space platforms; space stations; spacecraft systems and components such as thermal and environmental controls; and spacecraft control and stability characteristics. For life support systems, see 54 Man/System Technology and Life Support. For related information, see also 05 Aircraft Design, Testing and Performance, 39 Structural Mechanics, and 16 Space Transportation and Safety.*

**20030010282** NASA Langley Research Center, Hampton, VA USA

**Aerodynamics of Mars Odyssey**

Takashima, Naruhisa, AMA, Inc., USA; Wilmoth, Richard G., NASA Langley Research Center, USA; [2002]; 10p; In English; AIAA Atmospheric Flight Mechanics Conference and Exhibit, 5-8 Aug. 2002, Monterey, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 2002-4809; Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

Direct Simulation Monte Carlo and free-molecular analyses were used to provide aerothermodynamic characteristics of the Mars Odyssey spacecraft. The results of these analyses were used to develop an aerodynamic database that was used extensively for the pre-flight planning and in-flight execution for the aerobraking phase of the Mars Odyssey mission. During aerobraking operations, the database was used to reconstruct atmospheric density profiles during each pass. The reconstructed data was used to update the atmospheric model, which was used to determine the strategy for subsequent aerobraking maneuvers. The aerodynamic database was also used together with data obtained from on-board accelerometers to reconstruct the spacecraft attitudes throughout each aerobraking pass. The reconstructed spacecraft attitudes are in good agreement with those determined by independent on-board inertial measurements for all aerobraking passes. The differences in the pitch attitudes are significantly less than the preflight uncertainties of  $\pm 2.9\%$ . The differences in the yaw attitudes are influenced by zonal winds. When latitudinal gradients of density are small, the differences in the yaw attitudes are significantly less than the preflight uncertainties.

Author

*2001 Mars Odyssey; Aerothermodynamics; Monte Carlo Method; Direct Numerical Simulation; Atmospheric Models*

**20030010466** Boston Univ., Center for Space Physics, Boston, MA USA

**Constellation Pathfinder: A University Nanosatellite Project** *Final Report, 1 May 1999-30 Apr. 2002*

Spence, Harlan E.; Petschek, Harry E.; Aug. 16, 2002; 9p; In English

Contract(s)/Grant(s): F49620-99-1-0249

Report No.(s): AD-A408696; AFRL-SR-AR-TR-02-0376; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Under the task of nanosatellite mission design, we developed a mission concept that enables hundreds of one-kilogram spacecraft to be placed into orbit with a single mothership. We performed trade studies to arrive at a positive feasibility assessment. The results of that study were described in two publications. Second, under the task of spacecraft design, we developed nanosatellite designs needed to enable constellation missions. Design studies were conducted and subsystems prototyped, including a spin-table and launcher concept for a small stack of nanosatellites. Engineering design studies of this work appeared in the refereed literature. Instruments to be flown on such a small craft have been specified and then developed as part of a related AF SBIR effort. Undergraduate students (>100 in the Aerospace Engineering, Mechanical Engineering, and Electrical and Computer Engineering departments) played an enormous role in the mission and spacecraft definitions of the Constellation Pathfinder project. In addition to five publications, numerous invited and contributed presentations of these studies have been presented at national and international meetings.

DTIC

*Spacecraft; Space Missions; Nanosatellites; Feasibility Analysis; Aerospace Engineering; Spacecraft Design*

**20030011313** Air Force Research Lab., Space Vehicles Directorate, Hanscom AFB, MA USA

**A Feasible Approach for Implementing Greater Levels of Satellite Autonomy**

Lindsay, Steve; Zetocha, Paul; Jan. 2002; 7p; In English

Contract(s)/Grant(s): AF Proj. 8809

Report No.(s): AD-A408679; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

In this paper, we propose a means for achieving increasingly autonomous satellite operations. We begin with a brief discussion of the current state-of-the-art in satellite ground operations and flight software, as well as the real and perceived technical and political obstacles to increasing the levels of autonomy on today's satellites. We then present a list of system requirements that address these hindrances and include the artificial intelligence (AI) technologies with the potential to satisfy these requirements. We conclude with a discussion of how the space industry can use this information to incorporate increased autonomy. From past experience we know that autonomy will not just "happen," and we know that the expensive course of manually intensive operations simply cannot continue. Our goal is to present the aerospace industry with an analysis that will begin moving us in the direction of autonomous operations.

DTIC

*Artificial Intelligence; Ground Operational Support System; Aerospace Industry; Autonomy; Flight Control*

**20030011486** Air Force Research Lab., Propulsion Directorate, Wright-Patterson AFB, OH USA

**Solar Bi-Modal System Concept: Mission Applications, a Preliminary Assessment**

Laug, Kristi K.; Holmes, Michael R.; Westerman, Kurt O.; Jan. 1992; 6p; In English; Prepared in collaboration with Babcock and Wilcox, Lynchburg, VA

Report No.(s): AD-A408729; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The current fleet of medium/heavy expendable launch vehicles (ELVs) and upper stages are expensive, inflexible, and non-responsive to the needs of the satellite designer/builder. These transportation systems confine satellite designers to a very narrow operational envelope. If a satellite exceeds its mass budget by even a few percent, mission planners must choose between eliminating instrumentation (reducing the spacecraft's capabilities) or launching on a larger/more expensive ELV. Many people have suggested the development of a new, less expensive ELV to reduce launch costs. While such a system may eventually repay its development cost, current budgets do not make this approach practical. A new upper stage based on chemical technology is also likely to be expensive, with little performance improvement. In order to significantly improve the cost effectiveness of launch assets, alternate propulsion technologies must be developed. The approach to electrical power system design should also be modified. Currently, a new power system is designed for each new satellite. Each of these new power systems must be thoroughly developed, tested, and integrated into the satellite. While this process has produced extremely reliable power systems, the approach is very costly. An alternate approach, currently under investigation, is the use of a single power system with a standard interface to serve all satellites within a specified power range. This standard power system may also incorporate the stationkeeping functions of the satellite, an approach which has been referred to as the 'common bus'. While cost reductions are possible in both



the propulsion and power systems, numerous studies have shown that the combination of power and propulsion into a single system, the Bi-modal approach, may offer additional benefits as well.

DTIC

*Artificial Satellites; Power Supplies; Weight Reduction; Launch Vehicles*

## 19

### SPACECRAFT INSTRUMENTATION AND ASTRIONICS

*Includes the design, manufacture, or use of devices for the purpose of measuring, detecting, controlling, computing, recording, or processing data related to the operation of space vehicles or platforms. For related information, see also 06 Aircraft Instrumentation and Avionics; For spaceborne instruments not integral to the vehicle itself see 35 Instrumentation and Photography; For spaceborne telescopes and other astronomical instruments see 89 Astronomy, Instrumentation and Photography; For spaceborne telescopes and other astronomical instruments see 89 Astronomy.*

**20030007880** Space Research Organization Netherlands, Utrecht, Netherlands

#### **The Reflection Grating Spectrometer on Board XMM-Newton**

denHerder, J. W., Space Research Organization Netherlands, Netherlands; Brinkman, A. C., Space Research Organization Netherlands, Netherlands; Kahn, S. M., Columbia Univ., USA; Branduardi-Raymont, G., Mullard Space Science Lab., UK; Thomsen, K., Paul Scherrer Inst., Switzerland; Aarts, H., Space Research Organization Netherlands, Netherlands; Audard, M., Paul Scherrer Inst., Switzerland; Bixler, J. V., Lawrence Livermore National Lab., USA; denBoggende, A. J., Space Research Organization Netherlands, Netherlands; Oct. 02, 2000; 11p; In English

Contract(s)/Grant(s): NAS5-31429; SNSC-21-49343.96; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

The ESA X-ray Multi Mirror mission, XMM-Newton, carries two identical Reflection Grating Spectrometers (RGS) behind two of its three nested sets of Wolter I type mirrors. The instrument allows high-resolution ( $E/(\Delta E) = 100$  to 500) measurements in the soft X-ray range (6 to 38 Å or 2.1 to 0.3 keV) with a maximum effective area of about 140 sq cm at 15 Å. Its design is optimized for the detection of the K-shell transitions of carbon, nitrogen, oxygen, neon, magnesium, and silicon, as well as the L shell transitions of iron. The present paper gives a full description of the design of the RGS and its operational modes. We also review details of the calibrations and in-orbit performance including the line spread function, the wavelength calibration, the effective area, and the instrumental background.

Author

*Reflection; Spectrometers; Xmm-Newton Telescope; X Rays; Mirrors*

**20030011460** NASA Langley Research Center, Hampton, VA USA

#### **Early Radiometric Validation Results of the Ceres Flight Model 1 and 2 Instruments Onboard NASA's Terra Spacecraft**

Priestley, K. J., NASA Langley Research Center, USA; Wielicki, B. A., NASA Langley Research Center, USA; Green, R. N., NASA Langley Research Center, USA; Haeffelin, M. P. A., Virginia Polytechnic Inst. and State Univ., USA; Lee, R. B., NASA Langley Research Center, USA; Loeb, N. G., Hampton Univ., USA; Advanced Space Research; 2002; ISSN 0273-1177; Volume 30, No. 11, pp. 2371-2376; In English; Copyright; Avail: Issuing Activity

The CERES Flight Model 1 and 2 instruments were launched aboard NASA's Earth Observing System (EOS) Terra Spacecraft on December 18, 1999 into a 705 Km sun-synchronous orbit with a 10:30 a.m. equatorial crossing time. These instruments supplement measurements made by the CERES Proto Flight Model (PFM) instrument launched aboard NASA's Tropical Rainfall Measuring Mission (TRMM) spacecraft on November 27, 1997 into a 350 Km, 38-degree mid-inclined orbit. An important aspect of the EOS program is the rapid archival and dissemination of datasets measured by EOS instruments to the scientific community. On September 22, 2000 the CERES Science Team voted to archive the Edition 1 CERES/Terra Level 1b and Level 2 and 3 ERBE-Like data products. These products consist of instantaneous filtered and unfiltered radiances through temporally and spatially averaged TOA fluxes. CERES filtered radiance measurements cover three spectral bands including shortwave (0.3 to 5 micron), total (0.3 to less than 100 microns) and an atmospheric window channel (8 to 12 microns). The current work summarizes both the philosophy and results of validation efforts undertaken to quantify the quality of the Terra data products as well as the level of agreement between the Terra and TRMM datasets.

Author

*Terra Spacecraft; Satellite-Borne Instruments; Radiometers; Data Storage*

## SPACECRAFT PROPULSION AND POWER

*Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources. For related information, see also 07 Aircraft Propulsion and Power; 28 Propellants and Fuels; 15 Launch Vehicles and Launch Operations; and 44 Energy Production and Conversion.*

**20030007702** PRIMEX Technologies, Redmond, WA USA

**Low Bus Voltage Hydrazine Arcjet System for Geostationary Satellites**

Zube, Dieter M.; Fye, Dan; Jul. 1998; 7p; In English; Presented at the Joint Propulsion Conference (34th) Held in Cleveland, OH on July 13-15, 1998. Prepared as a AIAA Paper 98-3631

Report No.(s): AD-A408186; AFRL-PR-ED-TP-1998-139; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The capabilities of arcjet propulsion systems were recently extended to accommodate operation on the NASDA Data Relay Test Satellite (DRTS) providing a power bus voltage between 31 and 51.5 VDC. This paper summarizes the newly attained qualification status of the MR 512 arcjet system demonstrating the flexibility of the current design. A redesign of the Power Processing Unit (PPU) became necessary as well as a delta-qualification of the thruster to validate spacecraft integration and to provide compliance with the DRTS satellite environmental requirements. Two types of thrusters with different thrust levels were made available to meet mission requirements. The delta-qualification included a pyro-shock test, vibration tests to a higher level than previously tested, and performance mapping beyond the original range. Included in the paper is an assessment of the PPU performance characteristics as well as the discussion of the system operation and system telemetry.

DTIC

*Hydrazines; Arc Jet Engines; Synchronous Satellites; Spacecraft Power Supplies*

**20030007885** ATK-Thiokol Propulsion, Brigham City, UT USA

**Assessment of Various Flow Solvers Used to Predict the Thermal Environment inside Space Shuttle Solid Rocket Motor Joints**

Wang, Qun-Zhen, ATK-Thiokol Propulsion, USA; [2002]; 19p; In English; 38th AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, 7-10 Jul. 2002, Indianapolis, IN, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): NAS8-97238

Report No.(s): AIAA Paper 2002-4300; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution under U.S. Government purpose rights under contract number NAS8-97238; Distribution under U.S. Government purpose rights under contract number NAS8-97238

It is very important to accurately predict the gas pressure, gas and solid temperature, as well as the amount of O-ring erosion inside the space shuttle Reusable Solid Rocket Motor (RSRM) joints in the event of a leak path. The scenarios considered are typically hot combustion gas rapid pressurization events of small volumes through narrow and restricted flow paths. The ideal method for this prediction is a transient three-dimensional computational fluid dynamics (CFD) simulation with a computational domain including both combustion gas and surrounding solid regions. However, this has not yet been demonstrated to be economical for this application due to the enormous amount of CPU time and memory resulting from the relatively long fill time as well as the large pressure and temperature rising rate. Consequently, all CFD applications in RSRM joints so far are steady-state simulations with solid regions being excluded from the computational domain by assuming either a constant wall temperature or no heat transfer between the hot combustion gas and cool solid walls.

Author

*Computational Fluid Dynamics; Applications Programs (Computers); Space Shuttle Boosters; Thermal Environments; Joints (Junctions); Assessments*

**20030010278** NASA Marshall Space Flight Center, Huntsville, AL USA

**Dynamic Characterization of an Inflatable Concentrator for Solar Thermal Propulsion**

Leigh, Larry M., South Dakota State Univ., USA; Tinker, Michael L., NASA Marshall Space Flight Center, USA; [2002]; 4p; In English; Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

Solar-thermal propulsion is a concept for producing thrust sufficient for orbital transfers and requires innovative, lightweight structures. This note presents a description of an inflatable concentrator that consists of a torus, lens simulator, and three tapered struts. Modal testing was discussed for characterization and verification of the solar concentrator assembly. Finite element shell models of the concentrator were developed using a two-step nonlinear approach, and results were compared to test data.

Reasonable model-to-test agreement was achieved for the torus, and results for the concentrator assembly were comparable to the test for several modes.

Derived from text

*Concentrators; Solar Thermal Propulsion; Inflatable Structures; Dynamic Models; Simulation*

**20030011319** Air Force Research Lab., Propulsion Directorate West, Edwards AFB, CA USA

**Pulsed Thruster Thrust Stand Measurement Evaluations**

McFall, Keith A.; Spanjers, G. G.; Schilling, J. H.; Jul. 13, 1998; 11p; In English; Pres. at AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit (34th). Held in Cleveland, OH, 12-15 July 1998

Contract(s)/Grant(s): AF Proj. 3058

Report No.(s): AD-A408664; AFRL-PR-ED-TP-1998-142; AIAA Paper 98-3805; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper presents a numerical analysis of thrust stand response during pulsed thruster operation. The system model incorporates an underdamped displacement-type thrust stand under a periodic, impulsive load. Analytic and numerical methods are used to examine thrust stand measurement characteristics during simulated operation. Displacement oscillation characteristics as a function of damping coefficient ( $\alpha$ ) and the ratio ( $\tau$ ) between the time between thruster impulses and thrust stand natural period are presented. The effects of simulated thrust stand random displacement signal noise were quantified for  $\alpha=0.3$  with  $\tau$  varying from 0.1 to 0.7. These results show that measurement uncertainty due to noise decreases when  $\tau$  is increased. An analytic expression relating average thrust and average thrust stand displacement was derived. Using this expression, the effect of time-dependent, random thruster impulse variability was examined. Numerical simulations were used to estimate the dependence of thrust measurement uncertainty on the number of impulses used for averaging. These results also showed that measurement uncertainty due to impulse bit variability decreased when  $\tau$  is increased. Integration of 10 impulses is adequate to achieve measurement uncertainty below 2% for a random 10% impulse bit variation.

DTIC

*Numerical Analysis; Thrust Measurement; Displacement; Oscillations; Random Signals; Thrusters*

**20030011340** Air Force Research Lab., Edwards AFB, CA USA

**Paraboloidal Thin Film Inflatable Concentrators and Their Use for Power Applications**

Laug, Kristi K.; Holmes, Michael R.; Jun. 17, 1999; 10p; In English; Pres: 34th Intersociety Energy Conversion Engineering Conference

Contract(s)/Grant(s): Proj-1011

Report No.(s): AD-A408818; AFRL-PR-ED-TP-FY99-0121; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This paper deals with a proposal to use thin film inflatable concentrators, currently used for propulsion, in other applications, such as power. Technology for precision paraboloidal thin film concentrators is becoming available for use as a byproduct of propulsion technology. The idea is to introduce the possibility of using this formerly strictly propulsion hardware to power photovoltaic (PV) cells. Several intensity profiles will be generated from an optical model and shown for thin film inflatable concentrators.

DTIC

*Propulsion; Concentrators; Photovoltaic Cells*

**20030011413** Department of Defense, USA

**Ram Burn Observations (RAMBO)**

STS 107 Shuttle Press Kit: Providing 24/7 Space Science Research; Dec. 16, 2002, pp. 96; In English; Also announced as 20030011376; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Ram Burn Observations (RAMBO) is a Department of Defense experiment that observes shuttle Orbital Maneuvering System engine burns for the purpose of improving plume models. On STS-107 the appropriate sensors will observe selected rendezvous and orbit adjust burns.

Author

*Aerospace Technology Transfer; Technology Utilization; Spaceborne Experiments; Combustion; Rocket Engines; Rocket Exhaust; Models*

**20030011456** Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

**Investigation of the Operational Envelope of the CHAFF-4 Plume and Contamination Facility**

Lutfy, Fred M.; Muntz, E. P.; Ketsdever, Andrew D.; Jun. 14, 1999; 18p; In English; Prepared in collaboration with University of Southern California, Los Angeles

Report No.(s): AD-A408796; AFRL-PR-ED-TP-FY99-0140; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Interest in realistic simulation of the space environment as applied to the study of spacecraft contamination and thruster plumes has led to the development of the CHAFF-4 facility. CHAFF-4 uses a multi-fin cryogenically cooled array ( $\sim 20\text{K}$ ) that completely envelops the interior of the chamber providing an available condensing surface area of  $590\text{ m}^2$ . The geometry of the array capitalizes on the fact that both neutral and ion species from spacecraft propulsion systems predominantly undergo diffuse reflections when impacting at angles normal to the surfaces they encounter. Preliminary figures of merit for the equivalent altitude possible for various propulsion systems vary between 150-350 km (depending on thruster type). The effective pumping speed is predicted to be between  $3 \times 10^7$  and  $1 \times 10^8$  liters/sec. The facility is expected to accommodate thruster power levels up to 3500 W without the use of supplementary liquid helium, although infrastructure permitting its use is available. Developmental considerations and design issues are discussed in view of basic principles of plume testing and contamination, in order to ensure the integrity of phenomena that are observed in the facility. Provisions for the simulation of high-speed LEO flow environments have been incorporated in the design, and the corresponding pumping requirements are well within the capabilities of CHAFF-4.

DTIC

*Plumes; Contamination; Thrusters; Earth Orbital Environments; Aerospace Environments*

**20030011458** Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

**Computational Modeling of Low Reynolds Number Micronozzle Performance**

Ketsdever, Andrew D.; Wadsworth, Dean C.; Ivanov, Mikhail S.; Markelov, Guenadi N.; Jun. 14, 1999; 14p; In English; Prepared in collaboration with ERC, Inc., Edwards AFB, CA and Russian Academy of Sciences, Novosibirsk, Russia

Report No.(s): AD-A408799; AFRL-PR-ED-TP-FY99-0138; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Due to their simplicity, low thrust cold-gas propulsion systems have the potential to provide orbital maneuvering capability for small, micro- and even nano-satellites. Each specific mission where cold gas thrusts will be used places a unique set of requirements on the system. For example, micro-spacecraft with masses of 1 - 50 kg, will require thrust levels for typical orbital maintenance maneuvers of 0.1 - 10 mN. Missions which require precise attitude control, where the most important factor is a very low thrust will require thrust levels between 10 - 100 micro N. to obtain these low thrust values, small nozzle dimensions and low chamber pressures are usually used.

DTIC

*Reynolds Number; Propulsion System Configurations; Propulsion System Performance; Low Reynolds Number*

**20030011499** Alabama Univ., Dept. of Mechanical and Aerospace Engineering, Huntsville, AL USA

**Determination of Selected Material Properties of Castable Thin Film Polyimides for Applications in Solar Thermal Propulsion**

Paxton, James P.; Apr. 08, 1994; 20p; In English

Report No.(s): AD-A408753; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Partial contents; This Study will, What is a thin film?, An application of Thin Film polyimides, Typical Solar Thermal Rocket Configuration, Benefits of 6FDA +APB Thin Films, Design Parameters for Articles constructed with thin film polyimides, theory, thin film test apparatus, uniaxial test apparatus, toggle grip design, computer test panel, experimental procedure, Modulus of Elasticity results, Coefficient of Thermal Expansion results, Conclusions and Recommendations, Acknowledgement.

DTIC

*Modulus of Elasticity; Polyimide Resins; Solar Energy; Thin Films; Solar Thermal Propulsion*

**20030011527** Busek (J.) Co., Inc., Natick, MA USA

**A 1-D Time-Dependent Model of a Hall Thruster with Side Walls**

Rostler, Peter S.; Oct. 12, 2001; 25p; In English; Pres. at Intl. Electric Propulsion Conference. Held in Pasadena, CA, 15 Oct 2001. Paper no. IEPC-01-22

Contract(s)/Grant(s): F04611-99-C-0018; AF Proj. 3005

Report No.(s): AD-A408844; AFRL-PR-ED-TP-2001-202; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Previous one-dimensional Hall thruster models predict some observed features correctly, but do not adequately treat the losses of energy and ionization to the side walls of the channel. Because those losses have important effects on the discharge dynamics and the thruster's efficiency and lifetime, their omission severely limits the utility of a model. The model reported here is obtained



from a two- dimensional description by solving analytically for the radial variations of densities and velocities and then averaging over the radial coordinate in a way that retains the effects of the side walls. Our model also includes ion pressure, second ionization, a varying electron temperature, a diverging channel and a non-radial B field. It calculates the ion flux into the walls as well as the incident ion angles and energies as functions of axial position to predict the profile of erosion of the walls by sputtering. The collision and ionization rates are all treated as functions of the electron temperature. The derivation of the equations is explained and typical results of numerical solutions are presented.

DTIC

*Mathematical Models; Hall Thrusters*

**20030011528** Air Force Research Lab., Propulsion Directorate, Wright-Patterson AFB, OH USA

**Solar Thermal Propulsion from Concept to Reality Final Report**

Iliev, Karl J.; Aug. 1996; 12p; In English

Report No.(s): AD-A408846; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Solar thermal propulsion's multiple facets were studied and its application was looked at briefly. The efficiency and capability of select solar propulsion components were tested. During my brief tenure, several sinai' projects were begun, some completed. A calorimetry experiment tested the power output of the existing rigid concentrator. The process of constructing and testing an inflatable concentrator for slope errors and its power output was initiated. Slope errors will be measured using laser ray tracing techniques. A shutter was designed to quickly allow or block the passage of light onto the test subject in order to take more accurate measurements. Finally, different absorber, thruster, and propellant types and combinations were studied. Phillips Laboratory has been testing several different components in various important areas over the past 13 years. The ground tests will eventually provide enough information to build flight hardware. This culmination into several flight tests is the next step to reality of solar thermal propulsion.

DTIC

*Solar Energy; Solar Thermal Propulsion*

## 23

### CHEMISTRY AND MATERIALS (GENERAL)

*Includes general research topics related to the composition, properties, structure, and use of chemical compounds and materials as they relate to aircraft, launch vehicles, and spacecraft. For specific topics in chemistry and materials see categories 24 through 29. For astrochemistry see category 90 Astrophysics.*

**20030007695** California Inst. of Tech., Pasadena, CA USA

**Large Scale Spectral Hole Burning Memory in Organic Materials Final Report, 1 May 1999-30 Apr. 2002**

Psaltis, Demetri; Apr. 30, 2002; 15p; In English

Contract(s)/Grant(s): F49620-99-1-0258

Report No.(s): AD-A408171; AFRL-SR-AR-TR-02-0353; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Spectral hole burning is one special holographic technology, which requires to cool down the holographic material down to liquid helium temperature -270 degree of Celsius. However, it can record and generate very fast optical light pulse series and their interaction. Spectral hole burning is of critical interests for fast data storage and optical information processing. This work would be used to evaluate and study the general properties of the materials used for these application. This research is sponsored by the Air Force Office of Scientific Research under grant# F49620-99-1-0258.

DTIC

*Organic Materials; Data Storage; Optical Data Processing; Hole Burning; Optical Memory (Data Storage); Optical Data Storage Materials*

**20030007782** Environmental Protection Agency, Office of Solid Waste, Washington, DC USA

**Test Methods for Evaluating Solid Waste Physical/Chemical Methods: SW-846. Third Edition, 3B**

Aug. 2002; 167p; In English

Report No.(s): PB2003-100855; EPA-SW-846-03-03B; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

This document provides historical status information on EPA-published draft, proposed, and final SW-846 methods and chapters. It contains two status tables, namely; the 'SW-846 Method Status Table,' which is listing of SW-846 methods; and the 'Status Table for SW-846 Chapter Text and Other Documents', which lists all other documents in SW-846.

NTIS

*Hazardous Materials; Solid Wastes; Sampling; Chemical Analysis; Evaluation; Performance Tests*

**20030007802** Geological Survey, Water Resources Div., Tucson, AZ USA

**Ground-Water, Surface-Water, and Water-Chemistry Data, Black Mesa Area, Northeastern Arizona - 2000-2001, and Performance and Sensitivity of the 1988 USGS Numerical Model of the N Aquifer**

Thomas, B. E.; 2002; In English

Report No.(s): PB2003-101467; USGS/WRI-02-4211; No Copyright; Avail: National Technical Information Service (NTIS)

The N aquifer is the major source of water in the 5,400-square-mile area of Black Mesa in northeastern Arizona. Availability of water is an important issue in this area because of continued industrial and municipal use, a growing population, and precipitation of about 6 to 14 inches per year. The monitoring program in Black Mesa has been operating since 1971 and is designed to determine the long-term effects of ground-water withdrawals from the N aquifer for industrial and municipal uses. The monitoring program includes measurements of (1) ground-water pumping, (2) ground-water levels, (3) spring discharge, (4) surface-water discharge, and (5) ground-water chemistry.

NTIS

*Ground Water; Surface Water; Aquifers; Chemical Analysis; Geological Surveys*

**20030010287** Princeton Univ., NJ USA

**Vacuum Deposited Organic Light Emitting Devices on Flexible Substrates Final Report, 13 Jun. 1994-30 Apr. 2002**

Forrest, Stephen R.; Aug. 2002; 120p; In English

Contract(s)/Grant(s): F33615-94-1-1414; Proj-A940

Report No.(s): AD-A408636; AFRL-HE-WP-TR-2002-0147; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The objective of this eight year program was to demonstrate both passive and active matrix, flexible, small scale displays based on small molecular weight organic light emitting device (OLED) technology. The team comprised the University of Southern California, Universal Display Corporation, and Hughes Research Laboratories, and was led by Princeton University (PI: Stephen R. Forrest). The primary platform (device structure for research) at the outset of the program in 1994 was a stacked, full color OLED (SOLED) based on fluorescent emission. It was our objective to integrate SOLEDs on flexible active matrix backplanes based on small arrays of silicon-on-insulator transferred in thin film form from a silicon wafer 'handle.' Among the accomplishments of this program were the demonstration of transparent (TOLED), stacked flexible (FOLED), and ultrahigh efficiency phosphorescent OLEDs (PHOLED). Also, the use of several manufacturing technologies for the production of OLED displays were created and demonstrated, most notably the proprietary process of organic vapor phase deposition (OVPD).

DTIC

*Manufacturing; Substrates; Light Emitting Diodes; Vacuum Deposition; Flexibility; Organic Semiconductors*

**20030010474** Air Force Research Lab., Edwards AFB, CA USA

**High Resolution Infrared Absorption Spectra of Methane Molecules Isolated in Solid Parahydrogen Matrices**

Tam, Simon; Fajardo, Mario E.; Katsuki, Hiroyuki; Hoshina, Hiromichi; Momose, Takamasa; May 04, 1999; 23p; In English; Prepared in cooperation with Kyoto University and Japan Science and Technology Corporation (JST), Kyoto, Japan

Contract(s)/Grant(s): Proj-2303

Report No.(s): AD-A408708; AFRL-PR-ED-TP-FY99-0090; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We present high resolution (approx. = 0.01/cm) infrared absorption spectra of the V4 band of methane doped parahydrogen (CH<sub>4</sub>/pH<sub>2</sub>) solids produced by two different techniques: gas condensation in an enclosed cell at T approx. = 8 K, and rapid vapor deposition onto a T approx. = 2 K substrate in vacuum. The spectrum of the rapid vapor deposited solid contains a novel progression of single peaks with 5/cm spacing, superimposed over the known spectrum of CH<sub>4</sub> molecules trapped in sites of D<sub>3h</sub> symmetry in hexagonal close-packed (hcp) solid pH<sub>2</sub>. New theoretical calculations of the rovibrational transitions of a tetrahedral molecule in an external field of Oh symmetry permit the assignment of this new progression to CH<sub>4</sub> molecules trapped in crystalline face centered cubic (fcc) regions of the pH<sub>2</sub> solid. Annealing of the rapid vapor deposited samples to T approx. = 5 K decreases the intensities of the CH<sub>4</sub>/pH<sub>2</sub>(fcc) absorptions, and results in intensity changes for parallel and perpendicularly

polarized CH<sub>4</sub>/pH<sub>2</sub>(hcp) transitions. We discuss these phenomena, and the narrow (0.01 to 0.04/cm FWHM) absorption linewidths, in terms of the microscopic structure of the pH<sub>2</sub> hosts.

DTIC

*Crystal Structure; Infrared Spectra; Methane; Doped Crystals; High Resolution; Microstructure*

**20030011303** Academy of Sciences (USSR), Inst. of Physiologically Active Compounds, Moscow, USSR

**Fundamental Research on Combustion of Organophosphorous Esters and Synthesis of Promoting Additives** *Final Report, 1 Sep.-31 Aug. 2002*

Brel, Valery K.; Sep. 2002; 94p; In English; Original contains color images

Report No.(s): AD-A408572; ISTC-2171; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This report results from a contract tasking Institute of Physiologically Active Compounds as follows: Burning velocities and flammability limits for gaseous organophosphorous esters (OPE)/air mixtures, as well as effects of fluorine-containing additives on the burning velocities and flammability limits, will be determined. Fluorine-containing additives which promote combustion of OPE/air mixtures will be synthesized.

DTIC

*Esters; Organic Phosphorus Compounds*

**20030011342** California Univ., Dept. of Chemistry, Santa Barbara, CA USA

**Experimental Detection of the Pentazole Anion, N5(-)**

Vij, Ashwani; Pavlovich, James G.; Wilson, William W.; Christe, Karl O.; Apr. 01, 2002; 13p; In English

Contract(s)/Grant(s): Proj-DARP

Report No.(s): AD-A408825; AFRL-PR-ED-TP-2002-073; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The pentazole anion has been generated from para-hydroxyphenylpentazole and identified by electrospray ionization mass spectrometry. Whereas at low collision voltages the para-phenoxyphenylpentazole anion undergoes stepwise N<sub>2</sub> elimination generating the corresponding azide and nitrene, at high collision voltages the N5(-) anion is formed. Fragmentation of the pentazole anion produces the N3(-) anion as the principal negative ion. These experiments provide the first experimental proof for the existence of the pentazole anion. They also demonstrate that under suitable reaction conditions the C-N bond in a phenylpentazole can selectively be broken with conservation of the pentazole ring, thus providing a potential synthetic route to the pentazole anion.

DTIC

*Nitrogen Compounds; Anions; Negative Ions; Mass Spectroscopy; Ionization*

**20030011352** Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA

**Morphology and Morphological Changes Within Nafion Membranes Induced by Mechanical Orientation** *Interim Report, Jun. 1999-May 2001*

Trevino, S. F.; Young, Sandra K.; Nov. 2002; 34p; In English; Original contains color images

Report No.(s): AD-A408884; ARL-TR-2700; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The structure of Nafion, a perfluorosulfonated ionomer, has been the subject of many studies. Morphology evaluations have used the methods of small-angle x-ray scattering (SAXS), wide-angle x-ray scattering (WAXS), and small-angle neutron scattering (SANS). Three principal features in the small-angle scattering pattern have been observed on the H<sup>+</sup>-form Nafion. A peak at approximately Q approx. 0.2 Å<sup>-1</sup> is attributed to the clustering of the acid groups (ionomer peak), that at Q -0.03 Å<sup>-1</sup> to crystalline regions, and an upturn in intensity at the smallest Q to large-scale heterogeneities. Some of the previous works have included samples that have experienced moderate strains by mechanical elongation. In those works, the effect on the ionomer peak has been studied. The WAXS studies led to a model of the packing of the polymer molecules into ionic aggregates, while the SAXS and SANS studies resulted in models of the packing of the ionic clusters. In the present work, SANS measurements on elongated samples of Nafion have been used to obtain data that suggests a model of the structure of the material. The samples studied were elongated at two temperatures, 25 deg. and 155 deg. C. Although many of the scattering features of these two samples are similar, the samples stretched at 155 deg. C contain new information concerning the nature of the crystalline region.

DTIC

*Mechanical Properties; Chemical Composition; Membranes; Neutron Scattering; Ion Exchanging*

## COMPOSITE MATERIALS

*Includes physical, chemical, and mechanical properties of laminates and other composite materials.*

**20030007691** Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

**Mixed-Mode Fracture in a Rubbery Particulate Composite**

Miller, Timothy C.; Jun. 15, 1999; 18p; In English

Contract(s)/Grant(s): Proj-2302

Report No.(s): AD-A408177; AFRL-PR-ED-TP-FY99-0144; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

These viewgraphs discuss reasons for examining mixed-mode cracking in a rubbery particulate composite. The problem is presented, experimental procedures discussed, and results presented, such as crack initiation toughness results, kink angle results, and crack growth results. Conclusions and recommendations for future work are given.

DTIC

*Fracturing; Particulates; Composite Materials*

**20030007703** Swedish Defence Research Establishment, Aeronautics Div., Stockholm Sweden

**Buckling-Induced Delamination Analysis of Composite Laminates with Soft-Inclusion**

Zeng, L.; Olsson, R.; Feb. 2002; In English

Report No.(s): PB2003-101022; FOI-R-0412-SE; No Copyright; Avail: National Technical Information Service (NTIS)

In this paper, the effect of material impact damage on buckling-driven delamination growth in composite laminates under compression is studied using a finite element method. The initial material damage, e.g. fibre fracture and matrix cracking due to impact, is modeled through a so-called soft-inclusion, in which an area with reduced stiffness is introduced in the analysis of buckling-induced delamination growth with an ADINA-based finite element program. Parametric studies are carried out through numerical tests with different inclusion sizes and stiffness reductions, and a comparison with experiments is made. It is found that for single delaminations of moderate size, even significant stiffness reductions in one half of the delamination diameter have a fairly small influence on the initiation of delamination growth. Moreover, the experimentally measured local buckling load and deflection responses during delamination growth are lower than those predicted by the finite element model with severe stiffness reduction. It is concluded that such a soft-inclusion model is not sufficiently accurate to model the material damage, and more mathematically elaborated models which are capable to cope with material degradation, multiple delamination, crack closure and so on, should be developed.

NTIS

*Buckling; Laminates; Composite Materials; Delaminating*

**20030007719** Air Force Research Lab., Edwards AFB, CA USA

**Monitoring Initiation and Growth of Crack in a Particulate Composite Material Using Nondestructive Testing Techniques**

Liu, C. T.; Oct. 10, 2000; 3p; In English

Report No.(s): AD-A408159; AFRL-PR-ED-AB-2000-191; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

An important engineering problem in structural design is evaluating structural integrity and reliability. It is well known that structural strength may be degraded during its design life due to mechanical or chemical aging, or a combination of these two aging mechanisms. Depending on the structural design, material type, service loading, and environmental condition, the cause and degree of strength degradation due to the different aging mechanisms differs. One of the common causes of strength degradation is the result of crack development in the structure. In recent years, a considerable amount of work has been done in studying damage characteristics in highly filled polymeric materials, using nondestructive testing techniques. The importance of these studies stems from the fact that damage can significantly affect the constitutive and the crack growth behavior in these materials. Experimental findings reveal that damage, expressed in terms of the attenuation of the acoustic energy, increases with increasing strain rate and the critical damage is relatively insensitive to the strain rate. They also reveal that the damage state correlates well with the constitutive behavior of the material. In addition, for pre-cracked specimens, the damage state near the tip of a stationary crack is highly dependent on the loading history. In this study, Lockheed-Martin Research Laboratory's high-energy real-time x-ray system (HERTS) was used to monitor the processes of initiation and growth of damage and crack in edge-cracked sheet specimens. The specimens were made of a particulate composite material containing hard particles embedded in a rubber matrix and tested at a constant strain rate of 1.0 min to the minus 1 power. The experimental data were analyzed and the results were discussed.

DTIC

*Nondestructive Tests; Composite Materials; Crack Propagation; Particulates*



**20030007731** Swedish Defence Research Establishment, Aeronautics Div., Stockholm Sweden

**Measurements of Strains and Strength of Laminates with Artificial Damage**

Iwarsson, J.; Feb. 2002; In English

Report No.(s): PB2003-101021; FOI-R-0410-SE; No Copyright; Avail: CASI; C01, CD-ROM

Impact damage may reduce the strength and stiffness of laminated composite structures due to matrix cracking, delaminations and fiber failure. This study is focused on the effect of a local softer region caused by fiber fracture. This region is modeled as a notch-a hole, a soft inclusion or cut fibers. Several tests were performed in tension and compression with different notch sizes and the strain distributions on the surface were measured optically. The predicted strain and stress distributions for an inclusion in an infinite anisotropic plate were compared with the strain distribution. The point stress and the average stress criteria were used as failure criteria and compensated for finite width. This study showed that the average stress criterion gave a slightly better fit than the point stress criterion.

NTIS

*Laminates; Carbon Fiber Reinforced Plastics; Anisotropic Plates; Strain Distribution*

**20030010448** Bundesanstalt fuer Materialpruefung, Berlin Germany

**11TH International Symposium on Nondestructive Characterization of Materials**

Jun. 2002; 150p; In English

Contract(s)/Grant(s): N62558-02-M-5974

Report No.(s): AD-A408640; R/D-9285-AN-02; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This document contains symposium abstracts of papers given at the International Symposium on Nondestructive Characterization of Materials held in Berlin Germany on 24-28 Jun 2002.

DTIC

*Nondestructive Tests; Conferences; Composite Materials*

**20030011497** Oak Ridge Inst. for Science and Education, TN USA

**Implementation of the Nonlinear Composite Analysis Code 'LAMPAT' into LLNL-DYNA3D Final Report, Jan.-Sep. 2001**

Tabiei, Ala; Gazonas, George A.; Sep. 2002; 60p; In English; Original contains color images

Report No.(s): AD-A408759; ARL-TR-2846; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The nonlinear composite analysis code 'LAMPAT' is implemented in the nonlinear explicit finite element code LLNL-DYNA3D as a new user-defined material model. All subroutines of LAMPAT are implemented as user-defined Material Model 46. The user-defined material subroutine calls an external data base file that contains material properties for several composites. In addition, LAMPAT is modified for use in an explicit time-integration solver. The model is improved to account for loss of symmetry of the material stiffness matrix resulting from degradation of the elastic moduli during damage evolution. The model implementation is validated through a one-element simulation and penetration simulations. In addition, comparing the prediction of the LSDYNA elastic material model with that of LAMPAT validates the implementation.

DTIC

*Computer Programs; Composite Materials; Finite Element Method*

## 25

### INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY

*Includes the analysis, synthesis, and use inorganic and organic compounds; combustion theory; electrochemistry; and photochemistry. For related information see also 34 Fluid Dynamics and Thermodynamics, For astrochemistry see category 90 Astrophysics.*

**20030007697** Intermagnetics General Corp., Latham, NY USA

**Presidential Early Career Achievement Award for Dr Venkat Selvamanickam Final Report, for 1 Mar. 1997-31 Aug. 2002**

Selvamanickam, Venkat; Sep. 2002; 28p; In English

Contract(s)/Grant(s): F49620-97-C-0016

Report No.(s): AD-A408169; AFRL-SR-AR-TR-02-0368; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The objective of the program is to develop a fundamental understanding of YBCO film deposition by Metal Organic Chemical Vapor Deposition (MOCVD,) on biaxially textured metal substrates. MOCVD was chosen for several reasons. First, other than PLD only MOCVD has been shown to achieve high deposition rates in producing high quality YBCO as shown in Table I. Second, only MOCVD offers the advantage of both high deposition rate and large deposition area, which is important for high throughput.



This is shown in Table II. MOCVD offers other advantages too such as not being limited to line-of-sight deposition, separation of precursors from the deposition chamber (easy refill of precursors for unlimited regeneration), ability to modify film composition during deposition, and no target fabrication expense. When this program was begun 5 years ago, MOCVD of YBCO films suffered from problems such as reproducibility and stability. Also, no group had demonstrated high  $J_0$  and high  $I_c$  on biaxially-textured metal substrates. Further, no group had demonstrated high  $I_c$  and high  $J_0$  in YBCO films deposited in a moving mode. This program took upon the challenges to address to issues. The program includes a study of the a) influence of MOCVD processing conditions such as the flow rate of precursor vapors, precursor vaporization temperatures, oxygen partial pressure, reactor pressure, and the deposition temperature on the film features such as superconducting phase formation, composition, texture, deposition rates, uniformity in thickness, porosity and the presence of secondary phases, b) relationship between film microstructure and the critical current density ( $J_c$ ), and c) influence of metal substrate and buffer layers on the growth and performance of YBCO d) development of MOCVD hardware specifically for fabrication of high quality YBCO on metal substrates.

DTIC

*Metals; Microstructure; Films; Fabrication; Vapor Deposition; Substrates*

**20030007791** Virginia Univ., Aerospace Research Lab., Charlottesville, VA USA

**Dual-Mode Combustion of Hydrogen in a Mach 5, Continuous-Flow Facility**

Goyne, C. P., Virginia Univ., USA; McDaniel, J. C., Virginia Univ., USA; Quagliaroli, T. M., Virginia Univ., USA; Krauss, R. H., Virginia Univ., USA; Day, S. W., Virginia Univ., USA; Journal of Propulsion and Power; November - December 2001; Volume 17, No. 6, pp. 1313-1318; In English

Contract(s)/Grant(s): NAG1-2085; NAG1-2131; Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; Distribution under U.S. Government purpose rights under grant NAG1-2131; Distribution under U.S. Government purpose rights under grant NAG1-2131

Results of an experimental and numerical study of a dual-mode scramjet combustor are reported. The experiment consisted of a direct-connect test of a Mach 2 hydrogen-air combustor with a single unswept-ramp fuel injector. The flow stagnation enthalpy simulated a flight Mach number of 5. Measurements were obtained using conventional wall instrumentation and a particle-imaging laser diagnostic technique. The particle imaging was enabled through the development of a new apparatus for seeding fine silicon dioxide particles into the combustor fuel stream. Numerical simulations of the combustor were performed using the GASP code. The modeling, and much of the experimental work, focused on the supersonic combustion mode. Reasonable agreement was observed between experimental and numerical wall pressure distributions. However, the numerical model was unable to predict accurately the effects of combustion on the fuel plume size, penetration, shape, and axial growth.

Author

*Continuum Flow; Hybrid Propulsion; Mathematical Models; Combustion Chambers; Supersonic Combustion Ramjet Engines; Hydrogen Fuels; Computational Fluid Dynamics*

**20030007792** Virginia Univ., Aerospace Research Lab., Charlottesville, VA USA

**Dual-Mode Combustion Final Report, 1 Nov. 1998 - 31 May 2002**

Goyne, Christopher P., Virginia Univ., USA; McDaniel, James C., Virginia Univ., USA; October 2002; 4p; In English; Original contains color illustrations

Contract(s)/Grant(s): NAG1-2131; Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Distribution under U.S. Government purpose rights under grant NAG1-2131; Distribution under U.S. Government purpose rights under grant NAG1-2131

The Department of Mechanical and Aerospace Engineering at the University of Virginia has conducted an investigation of the mixing and combustion processes in a hydrogen fueled dual-mode scramjet combustor. The experiment essentially consisted of the "direct connect" continuous operation of a Mach 2 rectangular combustor with a single unswept ramp fuel injector. The stagnation enthalpy of the test flow simulated a flight Mach number of 5. Measurements were obtained using conventional wall instrumentation and laser based diagnostics. These diagnostics included, pressure and wall temperature measurements, Fuel Plume Imaging (FPI) and Particle Image Velocimetry (PIV). A schematic of the combustor configuration and a summary of the measurements obtained are presented. The experimental work at UVa was parallel by Computational Fluid Dynamics (CFD) work at NASA Langley. The numerical and experiment results are compared in this document.

Derived from text

*Combustion Chambers; Computational Fluid Dynamics; Supersonic Combustion Ramjet Engines; Aerospace Engineering; Hybrid Propulsion*

**20030010443** Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

**Relative Abilities of Fluorine and Chlorine to Stabilize Carbenium Ions. Crystal Structures of Two Fluoro-Substituted Carbocations and of As<sub>2</sub>F<sub>11</sub>**

Christe, Karl O.; Zhang, Xiongzh; Bau, Robert; Hegge, Joachim; Olah, George A.; Nov. 01, 1999; 47p; In English

Contract(s)/Grant(s): AF Proj. 2303

Report No.(s): AD-A408564; AFRL-PR-ED-TP-1999-0204; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The first crystal structures of fluoro-substituted carbocations without heteroatom stabilization and of the As<sub>2</sub>F<sub>11</sub>(-) anion are reported. The experimental geometries of the carbenium ions in (CH<sub>3</sub>)<sub>2</sub>CF(+)asF<sub>6</sub>(-), (M-CF<sub>3</sub>C<sub>6</sub>H<sub>4</sub>)(C<sub>6</sub>H<sub>5</sub>)CF(+)asF<sub>6</sub>(-) and (M-CF<sub>3</sub>C<sub>6</sub>H<sub>4</sub>)(C<sub>6</sub>H<sub>5</sub>)CF(+)as<sub>2</sub>F<sub>11</sub>(-) and their comparison with that of the (O-CIC<sub>6</sub>H<sub>4</sub>)(C<sub>6</sub>H<sub>5</sub>)CCl(+) cation show that, in accord with previous theoretical calculations, chlorine stabilizes carbenium ions more efficiently than fluorine. The apparent discrepancy between these findings and a previously reached conclusion, based on an analysis of sup 13 C NMR chemical shift difference data, are reconciled by using the direct sup 13 C chemical shifts for judging the donor strength of a ligand. The sup 13 C and sup 19 F NMR spectra of the (M-CF<sub>3</sub>C<sub>6</sub>H<sub>4</sub>)(C<sub>6</sub>H<sub>5</sub>)CF(+) cation were recorded and analyzed with the help of RHF/6-31G(d,p) calculations using the GIAO method. In each of the three fluoro-substituted carbocation crystal structures studied, the carbenium centers are further stabilized by forming two fluorine bridges with the anions, resulting in pseudo-trigonal bipyramidal environments around the carbenium centers. The F<sub>5</sub>As-F-AsF<sub>5</sub>(-) anion in (M-CF<sub>3</sub>C<sub>6</sub>H<sub>4</sub>)(C<sub>6</sub>H<sub>5</sub>)CF(+)as<sub>2</sub>F<sub>11</sub>(-) possesses a symmetric fluorine bridge with an As-F-As angle of 156.5(13) deg and staggered AsF<sub>4</sub> groups.

DTIC

*Stabilization; Cations; Carbon Compounds*

**20030010444** Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

**In Pursuit of the PO<sub>2</sub><sup>+</sup> Cation: The Reaction of KPO<sub>2</sub>F<sub>2</sub> and SbF<sub>5</sub> Leads to an Eight-Membered, Antimony-Oxygen-Phosphorus-Bridged Ring**

Schneider, Stefan; Vij, Ashwani; Sheehy, Jeffrey A.; Schroer, Thorsten; Christe, Karl O.; Dec. 08, 2000; 29p; In English; Prepared in collaboration with Loker Hydrocarbon Research Inst., Univ. of Southern California, Los Angeles, CA, and Univ. of California, Riverside, Riverside, CA

Contract(s)/Grant(s): AF Proj. 2303

Report No.(s): AD-A408567; AFRL-PR-ED-TP-2000-234; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The reaction of KPO<sub>2</sub>F<sub>2</sub> with the strong Lewis acid SbF<sub>3</sub> was studied as a potential pathway to the unknown PO<sub>2</sub>(+) cation. The resulting product has the desired PO<sub>2</sub>SbF<sub>6</sub> composition but consists of an 8-membered, oxygen-bridged ring that was characterized by vibrational and NMR (nuclear magnetic resonance) spectroscopy, ab initio methods, and a single crystal x-ray diffraction study. The formation of the oxygen-bridged ring and its mechanism are discussed.

DTIC

*Cations; Oxygen; Phosphorus; Single Crystals; Spectroscopy; Antimony; Crystal Structure*

**20030010446** Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

**Novel Synthesis of ClF<sub>6</sub><sup>+</sup> and BrF<sub>6</sub><sup>+</sup>**

Schroer, Thorsten; Christe, Karl O.; Oct. 04, 2000; 27p; In English; Prepared in collaboration with Loker Hydrocarbon Res. Inst., Univ. of Southern California, Los Angeles, CA

Contract(s)/Grant(s): AF Proj. 2303

Report No.(s): AD-A408569; AFRL-PR-ED-TP-2000-176; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

For a compound in a given oxidation state, its oxidizing strength increases from its anion to the neutral parent molecule to its cation. Similarly, an anion is more easily oxidized than its neutral parent molecule, which in turn is more easily oxidized than its cation. This concept was systematically exploited in our search for new superoxidizers. Transition metal fluoride anions were prepared in their highest known oxidation states by high temperature/high pressure fluorinations with elemental fluorine and subsequently converted to their more strongly oxidizing cations by a displacement reaction with a strong Lewis acid. The application of this principle resulted in new syntheses for ClF<sub>6</sub>(+)AsF<sub>6</sub>(-) and BrF<sub>6</sub>(+)AsF<sub>6</sub>(-) using the highly reactive and thermally unstable NiF<sub>3</sub>(+) cation which was prepared from the reaction of the NiF<sub>6</sub>(2-) anion with AsF<sub>5</sub> in aHF. Attempts to prepare the known KrF(+) and ClO<sub>2</sub>F<sub>2</sub>(+) cations and the yet-unknown XeF<sub>7</sub>(+) cation by the same method were unsuccessful. The results from this and previous studies show that NiF<sub>3</sub>(+) is a stronger oxidative fluorinator than PtF<sub>6</sub>, but whether its oxidizing strength exceeds that of KrF(+) remains unclear. Its failure to oxidize Kr to KrF(+) might have been due to unfavorable reaction conditions. Its failure to oxidize ClO<sub>2</sub>F to ClO<sub>2</sub>F<sub>2</sub>(+), in spite of its favorable oxidizer strength, is attributed to the high Lewis basicity of ClO<sub>2</sub>F which results in a rapid displacement reaction of NiF<sub>3</sub>(+) by ClO<sub>2</sub>F, thus generating the weaker oxidizer NiF<sub>4</sub> and the more difficult to oxidize substrate ClO<sub>2</sub>(+). Therefore, the general applicability of this approach appears to be limited to

substrates that exhibit a weaker Lewis basicity than the neutral transition metal parent molecule. Compared to  $\text{KrF}(+)$  or  $\text{PtF}_6$  based oxidations, the  $\text{NiF}_3(+)$  system offers the advantages of commercially available starting materials and higher yields, but product purification can be more difficult and tedious than for  $\text{KrF}(+)$ .

DTIC

*Synthesis (Chemistry); Oxidation; Metal Fluorides*

**20030010447** Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

**The Structure of the  $\text{SO}_2\text{F}$  Anion: A Problem Case**

Watson, Paul G.; Borrmann, Tobias; Vij, Ashwani; Boatz, Jerry A.; Christe, Karl O.; Jun. 19, 2000; 39p; In English; Prepared in collaboration with Loker Hydrocarbon Research Inst., Univ. of Southern California, Los Angeles, CA, and Dept. of Chemistry, Univ. of Bremen, Bremen, Germany

Contract(s)/Grant(s): AF Proj. 2303

Report No.(s): AD-A408570; AFRL-PR-ED-TP-2000-136; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Recently, room-temperature crystal structures of  $\text{SO}_2\text{F}(-)$  in its  $\text{K}(+)$  and  $\text{Rb}(+)$  salts were published in Z. Anorg. Allg. Chem. 1999, 625, 385 and claimed to represent the first reliable geometries for  $\text{SO}_2\text{F}(-)$ . However, their almost identical S-O and S-F bond lengths and O-S-O and O-S-F bond angles are in sharp contrast to the results from theoretical calculations. To clarify this discrepancy, the new  $(\text{CH}_3)_2\text{N}_3\text{SO}(+)$  and the known  $\text{N}(\text{CM}_3)_4(+)$ ,  $(\text{CH}_3)_2\text{N}_3\text{S}(+)$  and  $\text{K}(+)$  salts of  $\text{SO}_2\text{F}(-)$  were prepared and their crystal structures studied at low temperatures. Furthermore, the results from previous RHF and MP2 calculations were confirmed at the RHF, B3LYP and CCSD(T) levels of theory using different basis sets. It is shown that all the  $\text{SO}_2\text{F}$  salts studied so far exhibit varying degrees of oxygen-fluorine and, in some cases, oxygen site disorders, with  $(\text{CH}_3)_2\text{N}_3\text{SO}(+)$   $\text{SO}_2\text{F}(-)$  at 113 deg K showing the least disorder with  $r(\text{SF})-r(\text{SO}) = 17$  pm and is less than  $(\text{OSO})-$  is less than  $(\text{FSO}) = 6$  deg. Refinement of the disorder occupancy factors and extrapolation of the observed bond distances for zero disorder resulted in a geometry very close to that predicted by theory. The correctness of the theoretical predictions for  $\text{SO}_2\text{F}(-)$  is further supported by the good agreement between the calculated and the experimentally observed vibrational frequencies and their comparison with those of isoelectronic  $\text{ClO}_2\text{F}$ . A normal coordinate analysis of  $\text{SO}_2\text{F}$  confirms the weakness of the S-F bond with a stretching force constant of only 1.63 mdyn/A and shows that there is no highly characteristic S-F stretching mode. The S-F stretch strongly couples with the  $\text{SO}_2$  deformation modes and is concentrated in the two lowest  $a(\text{sup } 1)$  frequencies.

DTIC

*Crystal Structure; Sulfur Compounds; Sulfur Dioxides; Potassium; Rubidium*

**20030010454** Air Force Research Lab., Kirkland AFB, NM USA

**Observation of Quantum-Confined Stark Effect in Triple-Coupled InGaAs/GaAs/ AlGaAs Quantum Well Infrared Photodetector**

Li, Sheng S.; Chiang, J. C.; Singh, A.; Tidrow, M. Z.; Aug. 1997; 15p; In English

Contract(s)/Grant(s): Proj-2305

Report No.(s): AD-A408663; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We have investigated the quantum-confined Stark effect (QCSE) in several n-type InGaAs/GaAs/AlGaAs triple-coupled quantum well infrared photodetectors (TC-QWIPs) for 8-12 micrometers long wavelength infrared (LWIR) detection. The basic structure of this TC-QWIP consists of three coupled quantum wells (QWs) formed by a Si-doped  $\text{In}(x)\text{Ga}(1-x)\text{As}$  QW and two undoped thin GaAs QWs separated by two thin  $\text{Al}(y)\text{Ga}(1-y)\text{As}$  barriers. Three TC-QWIP devices with varying indium and aluminum compositions were fabricated and characterized. A strong QCSE for the (E1 to E3) transition was observed in the wavelength range of 8.2 - 9.1 micrometers, 10.8 - 11.5 micrometers, and 9.4 - 10.7 micrometers for QWIP-A, -B, and -C, respectively. These devices exhibit a linear dependence of peak wavelength on the applied bias voltage over these wavelengths ranges. Peak responsivities,  $R(1) = 0.05, 0.33$  A/W and detectivities,  $D(\text{BLIP}) = 6.1 \times 10^9, 1.63 \times 10^{10} \text{ cm-Hz}^{1/2}/\text{W}$  at  $V(b)=5, 4$  V,  $\lambda(p)=8.6, 11.2$  micrometers, and  $T(\text{BLIP})=66, 50$  K were obtained for QWIP-A and -B, respectively. For QWIP-C,  $R(1) = 0.19$  A/W was obtained at  $\lambda(p)=9.3$  micrometers,  $V(b)=7$  V, and  $T=60$  K.

DTIC

*Aluminum Gallium Arsenides; Indium Gallium Arsenides; Infrared Detectors; Photometers; Quantum Wells; Stark Effect*

**20030010475** Air Force Research Lab., Edwards AFB, CA USA

**CO/pH<sub>2</sub>: A Molecular Thermometer**

Tam, Simon; Fajardo, Mario; Jun. 16, 2000; 14p; In English

Contract(s)/Grant(s): Proj-2303

Report No.(s): AD-A408709; AFRL-PR-ED-TP-2000-129; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We utilize reversible temperature dependent changes in the IR absorption spectrum of CO molecules isolated in solid parahydrogen (pH<sub>2</sub>) to probe bulk temperature changes during rapid vapor deposition. The intensity of a well resolved feature near 2135/cm increases monotonically with temperature over the 2 to 5 K range. The thermally populated initial state of this transition lies approx. 8 K above the CO/pH<sub>2</sub> ground state. During the deposition of approx. 100 ppm CO/pH<sub>2</sub> samples, we detect temperature gradients 10 K/cm in 0.1 cm-thick samples subjected to heat loads 10 mW/sq cm. The resulting estimated thermal conductivity (TC) is 3(+ or -2) mW/cm-K, averaged over the 2 to 5 K region. This value is 1000 times lower than the TC of single crystal solid pH<sub>2</sub>, and 10 times lower than previously measured for pH<sub>2</sub> solids doped with 100 ppm concentrations of heavy impurities (Manzhelii, Gorodilov, and Krivchikov, Low Temp. Phys. 22, 131 (1996)). We attribute this abnormally low TC to the known mixed fcc/hcp structure of the rapid vapor deposited solids.

DTIC

*Thermal Conductivity; Carbon Monoxide; Absorption Spectra; Thermometers; Infrared Absorption*

**20030011255** Air Force Research Lab., Propulsion Directorate West, Edwards AFB, CA USA

**The New Bicyclic Nitrogen Tetroxide Cation, NO<sub>4</sub>(+) Has a Low Decomposition Energy**

Korkin, Anatoli A.; Bartlett, Rodney J.; Nooijen, Marcel; Christe, Karl O.; Mar. 17, 1998; 9p; In English; Prepared in cooperation with University of Florida, Gainesville

Contract(s)/Grant(s): F04611-93-C-0005; AF Proj. 3058

Report No.(s): AD-A408710; AFRL-PR-ED-TP-1998-068; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Nitrogen oxide cations, such as NO<sub>2</sub>(+) and NO(+), are strong oxidizers and useful components for ionic High Energy Density Materials (HEDM) 1. Their energy content and oxidizing power increase with increasing oxidation state of the nitrogen atom and the number of oxygen ligands. In our search for related, halogen-free, highly energetic cations we have become interested in the bicyclic NO<sub>4</sub>(+)(I).

DTIC

*Nitrogen Oxides; Vibrational Spectra*

**20030011259** Air Force Research Lab., Propulsion Directorate West, Edwards AFB, CA USA

**Rapid Vapor Deposition of Millimeters Thick Optically Transparent Parahydrogen Matrices**

Fajardo, Mario E.; Tam, Simon; Jun. 23, 1999; 40p; In English; Briefing notes only

Contract(s)/Grant(s): AF Proj. 2303

Report No.(s): AD-A408613; AFRL-PR-ED-TP-1999-0158; No Copyright; Avail: Defense Technical Information Center (DTIC)

Charts and graphs from presentation given at the Gordon Research Conference on Physics and Chemistry of Matrix Isolated Species. Held at Plymouth State College, 14 Jul 1999.

DTIC

*Vapor Deposition; Hydrogen; Absorption; Solid Phases*

**20030011265** Air Force Research Lab., Space and Missile Propulsion, Edwards AFB, CA USA

**High Resolution Infrared Absorption Spectroscopy of Molecular Dopants in Cryogenic Solid Parahydrogen**

Fajardo, Mario E.; Tam, Simon; Jun. 01, 1999; 46p; In English; Abstract and briefing charts only. Pres. at High Energy Density Matter Contractors Conf. Held in Cocoa Beach, FL, 8-11 Jun 1999

Contract(s)/Grant(s): AF Proj. 2303

Report No.(s): AD-A408603; AFRL-PR-ED-TP-1999-0110; No Copyright; Avail: Defense Technical Information Center (DTIC)

Premature claims of successful energy storage in cryogenic solids date back to the National Bureau of Standards' Free Radicals program. Such errors typically result from reliance on unsupplemented calorimetric data, which shed little light on the mechanism of energy storage i.e. chemical identities of the energetic species and microscopic structures within the trapping medium. Only spectroscopic measurements provide the species and structure specific information required for directed incremental progress towards higher stored energy densities. In HEDM program funded studies, Oka and co-workers pioneered the use of high resolution spectroscopic techniques in solid parahydrogen (pH<sub>2</sub>). Our rapid vapor deposition sample preparation technique now enables us to trap virtually any volatilizable species in solid pH<sub>2</sub>. We present results of high resolution infrared absorption experiments on pH<sub>2</sub> solids doped with isolated molecules and small clusters.

DTIC

*Absorption; High Energy Propellants; Cryogenic Rocket Propellants; Absorption Spectroscopy; Doped Crystals; Para Hydrogen*



**20030011289** Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

**Promising Thermal Source of Boron Atoms**

Harper, J.; Larson, C. W.; Jun. 02, 1999; 19p; In English; Technical paper and charts

Contract(s)/Grant(s): AF Proj. 2303

Report No.(s): AD-A408598; AFRL-PR-ED-TP-1999-0130; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A "cannon" design has been tested as a high flux thermal source of pure boron atoms. Boron is packed into a central channel of a 1/4 in graphite rod with the open end pointed towards the deposition substrate. A refractory metal sheath surrounds and heats the carbon as the applied current increases. Successful argon matrix isolation experiments indicate that the boron cannon will be an effective way to produce pure boron atoms. Products from previous thermal techniques that used carbon as a container in which to heat boron, have been heavily contaminated with carbon and boron/carbon compounds. The cannon design exploits the difference in vapor pressures of boron and carbon at a given temperature. The design, operating temperature, and procedure for heating the cannon are still being optimized. Because of the higher flux of boron, hard to detect species such as B<sub>2</sub>C, are more easily observed. Experiments also confirm that carbon monoxide (CO) is a thorough scavenger of boron atoms. When large amounts of CO are present, BCO and clusters of these molecules are the only products. This procedure could be developed into a diagnostic for the presence of B atoms.

DTIC

*Boron; Carbon Compounds; Refractory Metals; Operating Temperature; Carbon Monoxide*

**20030011291** Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

**Bond Dissociation Energies of Energetic Compounds: A Comparison of Theoretical Methods**

Boatz, Jerry A.; Thompson, Donald L.; Oct. 25, 2000; 16p; In English; Prepared in collaboration with Dept. of Chemistry, Oklahoma State Univ., Stillwater, OK

Contract(s)/Grant(s): AF Proj. 2303

Report No.(s): AD-A408566; AFRL-PR-ED-TP-2000-206; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Due to their computational efficiency, density functional methods utilizing semiempirical hybrid functionals such as B3LYP are commonly used in calculating the molecular potential energy surfaces of a wide variety of molecules. In particular, potential energy surfaces of several energetic compounds such as hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX), 1,3,3-trinitroazetidine (TNAZ), 5-nitro-2,4-dihydro-3H-1,2,4-triazolone (NTO), and 1,1-diamino-2,2-dinitroethylene recently have been computed using density functional methods (B3LYP). These potential energy surfaces are used, for example, to predict the decomposition mechanisms and for constructing force fields for modeling and simulation of solid state phase transitions. The accuracy of B3LYP relative energies and structures is generally observed to be comparable to that obtained using second order perturbation theory methods. However, an unresolved issue is the reliability of density functional based methods in cases where a significant degree of multiconfigurational character may be present in the compounds of interest, such as in the energetic molecules listed above. The present study is a systematic comparison of several electronic structure methods in the prediction of bond dissociation energies of energetic molecules. In particular, the C-NO<sub>2</sub> and C-NH<sub>2</sub> bond dissociation energies of 1,1-diamino-2,2-dinitroethylene and its prototypes are used as a testbed for comparison of B3LYP with single configuration self-consistent field (SCF), second order perturbation theory (MP2), and coupled-cluster (CCSD(T)) calculations as well as multiconfigurational SCF (MCSCF) and quasi-dependent perturbation theory (MCQDPT) methods.

DTIC

*Dissociation; Phase Transformations; Field Theory (Physics); Electronic Structure; Perturbation Theory*

**20030011298** Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

**The Synthesis and Characterization of New Energetic Salts**

McKay, Milton, Air Force Research Lab., USA; Drake, Greg; Tollison, Kerri; Hawkins, Tom; Brand, Adam; Sep. 20, 2000; 3p; In English; Presented at HEDM Conf. Held in Park City, UT, 24-26 Oct, 2000

Contract(s)/Grant(s): AF Proj. 2303

Report No.(s): AD-A408591; AFRL-PR-ED-AB-2000-179; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

As growing concerns arise over the use of hydrazine in monopropellant systems, alternatives to replace it are being sought by several investigators in the field. At AFRL, we have been pursuing the use of energetic salts as viable monopropellant ingredients. They have several inherent advantages over hydrazine, including essentially no vapor pressure, which results in low vapor toxicities, significantly higher densities overall, significantly higher performing materials.

DTIC

*Salts; Hydrazines; Vapors; Vapor Pressure*



**20030011302** Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

**The Synthesis and Characterization of New Energetic Salts**

Drake, Greg; Tollison, Kerri; Hawkins, Tom; Brand, Adam; McKay, Milton; Oct. 25, 2000; 30p; In English  
Report No.(s): AD-A408574; AFRL-PR-ED-TP-2000-207; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche  
No abstract available.

DTIC

*Synthesis (Chemistry); Salts*

**20030011316** Engineering Research and Consulting, Inc., Edwards AFB, CA USA

**Studies on the Generation of the Pentazole Anion and Singlet-Delta Molecular Oxygen**

Christe, Karl O.; Wilson, William W.; Vij, Ashwani; Vij, Vandana; Alfano, Angelo; May 09, 2002; 3p; In English; AFOSR Molecular Dynamics Conference, 20 May 2002, Boston, MA, USA; Prepared in cooperation with Loker Hydrocarbon Research Inst., Univ. of Southern California, Los Angeles, CA, Dept. of Chemistry, Univ. of California, Santa Barbara, CA and Propulsion Sciences and Advanced Concepts Div., AFRL, Edwards AFB, CA

Contract(s)/Grant(s): F04611-99-C-0025; AF Proj. DARP

Report No.(s): AD-A408675; AFRL-PR-ED-AB-2002-107; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Under combined DARPA, AFOSR and NSF sponsorship, we have discovered, in 1999, the novel polynitrogen cation, N<sub>5</sub><sup>+</sup>.

DTIC

*Synthesis (Chemistry); Anions; Azoles; Oxygen*

**20030011320** Air Force Research Lab., Propulsion Directorate West, Edwards AFB, CA USA

**Experimental and Theoretical Characterization of the Oxygen-Coordinated Donor-Adducts of COCl<sub>2</sub>, COClF and COF<sub>2</sub> with AsF<sub>5</sub> and SbF<sub>5</sub>**

Hoge, Berthold; Boatz, Jerry A.; Christe, Karl O.; Mar. 04, 1999; 24p; In English

Contract(s)/Grant(s): F04611-93-C-0005; AF Proj. 2303

Report No.(s): AD-A408660; AFRL-PR-ED-TP-FY99-0049; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

When reacted with an excess of the corresponding carbonyl halides, AsF<sub>5</sub> and SbF<sub>5</sub> from the following 1:1 adducts: COCl<sub>2</sub>\*AsF<sub>5</sub>, COCl<sub>2</sub>\*SbF<sub>5</sub>, COClF\*AsF<sub>5</sub>, COClF\*SbF<sub>5</sub>, COF<sub>2</sub>\*AsF<sub>5</sub> and COF<sub>2</sub>\*SbF<sub>5</sub>. All adducts are unstable at ambient temperature, and their dissociation enthalpies were determined from the dissociation pressure curves. Vibrational and multinuclear NMR spectra and theoretical calculations show that all compounds are oxygen-coordinated donor-acceptor adducts, and that the strengths of the oxygen-bridges increase from COF<sub>2</sub> to COCl<sub>2</sub> and from AsF<sub>5</sub> to SbF<sub>5</sub>.

DTIC

*Synthesis (Chemistry); Nuclear Magnetic Resonance; Vibrational Spectra; Ambient Temperature*

**20030011323** Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

**HEDM Source Characterization by Multi-Photon Ionization Time-of-Flight Mass Spectrometry**

DeRose, Michelle E.; Fajardo, Mario E.; May 1999; 28p; In English; Viewgraphs and briefing notes only. Pres. at High Energy Density Matter Contractors Conference. Held in Cocoa Beach, FL, 8-11 Jun 1999

Contract(s)/Grant(s): AF Proj. 2303

Report No.(s): AD-A408654; AFRL-PR-ED-TP-1999-0115; No Copyright; Avail: Defense Technical Information Center (DTIC)

We present results obtained using an apparatus designed to characterize the species produced by a variety of HEDM sources. In this apparatus, the HEDM species are ionized by a pulsed excimer laser beam and analyzed by time-of-flight mass spectrometry. Complications arising from photofragmentation vs. photoionization were encountered and documented as a function of ionization wavelength and intensity.

DTIC

*Time of Flight Spectrometers; Ionization; Photoionization; Mass Spectroscopy*

**20030011324** Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

**The Tetrafluorohalogen Cations ClF<sub>4</sub><sup>+</sup>, BrF<sub>4</sub><sup>+</sup>, and IF<sub>4</sub><sup>+</sup> and Their Isoelectronic Counterparts SF<sub>4</sub>, SeF<sub>4</sub>, and TeF<sub>4</sub>**

Christe, Karl O.; Zhang, Xiongzh; Sheehy, Jeffrey A.; Bau, Robert; Feb. 08, 2000; 3p; In English; Prepared in collaboration with Dept. of Chemistry, Univ. of Southern California, Los Angeles, CA. Pres. at meeting of American Chemical Society. Held in San Francisco, CA, 26-30 Mar 2000

Contract(s)/Grant(s): AF Proj. 2303

Report No.(s): AD-A408652; AFRL-PR-ED-AB-2000-028; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche  
The crystal structure of the 1:1 adduct, ClF5SbF5, was determined and shown to contain discrete ClF4<sup>+</sup> and SbF6<sup>-</sup> ions.  
DTIC

*Synthesis (Chemistry); Halogen Compounds; Isoelectronic Sequence*

**20030011325** Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

**Quantitative Matrix Isolation Spectroscopy in Heavily Doped Millimeters Thick Parahydrogen Solids**

Tam, Simon; Fajardo, Mario E.; Jun. 24, 1999; 22p; In English

Contract(s)/Grant(s): AF Proj. 2303

Report No.(s): AD-A408621; AFRL-PR-ED-TP-1999-0159; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The objective of this research is to develop a technique for quantifying dopant species identities and concentrations in optically dense samples using the dopant-induced infrared absorptions.

DTIC

*Absorption; Doped Crystals; Para Hydrogen; Infrared Radiation*

**20030011328** Air Force Research Lab., Space and Missile Propulsion, Edwards AFB, CA USA

**High Resolution Infrared Absorption Spectroscopy of C60 Molecules and Clusters in Parahydrogen Solids**

Tam, Simon; DeRose, Michelle E.; Fajardo, Mario E.; Sogoshi, Norihito; Kato, Yoshiyasu; Nov. 03, 1999; 39p; In English; Prepared in collaboration with Dept. of Chemistry, Kyoto Univ., and Japan Science and Technology Corp. (JST), Kyoto, Japan

Contract(s)/Grant(s): AF Proj. 2303

Report No.(s): AD-A408601; AFRL-PR-ED-TP-1999-0209; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We report the isolation of C60 molecules in cryogenic pH2 solids by the rapid vapor deposition method. New theoretical simulations of rovibrational spectra for low temperature isolated (12)C60 molecules, including boson-exchange symmetry restrictions on the rotational levels, predict a characteristic 'null gap' and unequal rotational line spacings for low-J values. High-resolution(IR) absorption spectra of the C60/pH2 samples failed to show rotationally resolved features, and in fact suggest that the majority of the C60 molecules are not rotating. However, spectra of the F1u(1) vibrational mode near 530 cm<sup>-1</sup> show linewidths of approximately 0.2 cm<sup>-1</sup>(FWHM), the sharpest IR absorption bands for C60 reported to date. Visible absorption spectra also show sharp features in the 600 nm region, supporting our contention of well isolated C60 molecules. The C60 molecules appear to stabilize the pH2 solid, inhibiting the fcc to hcp conversion which usually occurs upon annealing of rapid vapor deposited pH2 solids to T is approximately 5 K. We also report surprisingly strong C60-induced IR activity in the pH2 solid, and propose this phenomenon as a diagnostic for H2 molecules adsorbed by carbon nanotubes. C60/pH2 samples grown in an enclosed cell by laser ablation of solid C60 appear to contain predominantly (C60)<sub>n</sub> clusters; these clusters are too small to exhibit "bulk" vibrational or electronic properties, as determined by IR and UV/visible absorption spectroscopies. Future experiments to disentangle the contributions of <sup>13</sup>C isotopic substitution, pH2 matrix effects, and the putative hindered rotation of C60 molecules to the observed C60/pH2 IR lineshapes are presently under consideration.

DTIC

*Fullerenes; Absorption Spectra; Absorption Spectroscopy; Carbon Nanotubes; Infrared Absorption*

**20030011332** Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

**Measurement of Large Dopant Concentrations by Dopant-Induced Infrared Activity in Solid Parahydrogen**

Tam, Simon; Fajardo, Mario E.; Jun. 01, 1999; 14p; In English; Viewgraphs only. High Energy Density Matter Contractors Conf. Held in Cocoa Beach, FL, 8-11 Jun 1999

Contract(s)/Grant(s): AF Proj. 2303

Report No.(s): AD-A408596; AFRL-PR-ED-TP-1999-0116; AFRL-PR-ED-TP-1999-0116; No Copyright; Avail: Defense Technical Information Center (DTIC)

Conference presentation on the measurement of large dopant concentrations by dopant-induced infrared activity in solid parahydrogen,

DTIC

*Para Hydrogen; Infrared Radiation; Additives*

**20030011333** Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

**Synthesis of Catenated Polynitrogen Compounds**

Christe, Karl O.; Wilson, William W.; Boatz, Jerry A.; Sheehy, Jeffrey A.; May 27, 1999; 32p; In English; Prepared in collaboration with Raytheon ITSS. Viewgraphs only

Contract(s)/Grant(s): AF Proj. 2303

Report No.(s): AD-A408595; AFRL-PR-ED-TP-1999-0114; AFRL-PR-ED-TP-1999-0114; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Presentation includes overview of synthesis of novel compounds consisting of highly endothermic polynitrogen allotropes; use techniques developed in synthesis of other energetic materials to pursue catenated rather than polycyclic polynitrogen compounds; use theory and calculations to guide synthesis efforts; and potential payoffs.

DTIC

*Nitrogen Compounds; Endothermic Reactions*

**20030011335** Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

**The Synthesis and Characterization of Methylene Bisoxamine CH<sub>2</sub>(-O-NH<sub>2</sub>)<sub>2</sub> Salts**

Tollison, Kerri; Drake, Greg; Hawkins, Toma; Brand, Adam; McKay, Milton; Sep. 20, 2000; 3p; In English; Prepared in collaboration with ERC, Inc., Edwards AFB, CA, and SRI Intl., Inc., Menlo Park, CA. Pres. at HEDM Conf. Held in Park City, UT, 24-26 Oct 2000

Contract(s)/Grant(s): AF Proj. 2303

Report No.(s): AD-A408592; AFRL-PR-ED-AB-2000-180; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The quest for new energetic materials for propellant research and development is an ongoing research effort at many facilities. Methylene bisoxamine, CH<sub>2</sub>(-O-NH<sub>2</sub>)<sub>2</sub>, was first synthesized in the late 1960's at Edwards Air Force Base, as a colorless, stable liquid. The diperchlorate salt was heavily investigated as a solid propellant ingredient, but was dropped because of its slight impact sensitivity. Methylene bisoxamine is an oxamine base capable of yielding both mono- and di-protonated species, depending on the stoichiometry used in its reactions with acidic materials. We have reinvestigated this highly energetic material, and have synthesized and fully characterized a large family of new salts, including species paired with the nitrate, perchlorate, dinitramide and nitroformate anions. All of the salts were characterized by vibrational (IR, Raman), multinuclear nmr (1H, 13C) spectra, differential scanning calorimetry (DSC) studies, and elemental analyses. Safety testing, including friction and impact tests, were carried out on all of the new salts, as well thermal stability studies at elevated temperatures, and all these results will be presented.

DTIC

*Salts; Methylene; Nuclear Magnetic Resonance; Impact Resistance; Thermal Stability*

**20030011341** Engineering Research and Consulting, Inc., Edwards AFB, CA USA

**Nitrogen Fluoride Chemistry**

Vij, Ashwani; Wilson, William; Vij, Vandana; Christe, Karl; Tham, F.; Jun. 12, 2002; 3p; In English; Prepared in cooperation with University of California, Riverside, CA and University of Southern California, Los Angeles, CA. Abstract only

Contract(s)/Grant(s): F04611-99-C-0025; Proj-DARP

Report No.(s): AD-A408824; AFRL-PR-ED-AB-2002-140; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The isomerization of trans-N<sub>2</sub>F<sub>2</sub> to cis-N<sub>2</sub>F<sub>2</sub> going through N<sub>2</sub>F(+)AsF<sub>6</sub>(-) is unpredictable, erratic, requires 2 steps, and consumes an equimolar amount of AsF<sub>5</sub>. It was found that catalytic amounts of SbF<sub>5</sub> at 30C can achieve this isomerization, but still result in substantial N<sub>2</sub>F<sub>2</sub> losses due to N<sub>2</sub>F(+)SbF<sub>6</sub>(-) formation. When the reaction is carried out at 60C, surprisingly NF<sub>4</sub>(+)SbF<sub>6</sub>(-). nSbF<sub>5</sub> is formed. The crystal structures of N<sub>2</sub>F(+)SbF<sub>6</sub>(-) (disordered), N<sub>2</sub>F(+) SbF<sub>6</sub>(-) (disordered), N<sub>2</sub>F(+)Sb<sub>2</sub>F<sub>11</sub>(-) (ordered), and NF<sub>4</sub>(+)Sb<sub>2</sub>F<sub>11</sub>(-) were determined and are discussed. AlF<sub>3</sub> was also studied as a catalyst for the N<sub>2</sub>F<sub>2</sub> isomerization and was found to be an ideal catalyst resulting in very high conversions of trans-N<sub>2</sub>F<sub>2</sub> and high yields of cis-N<sub>2</sub>F<sub>2</sub>. The AlF<sub>3</sub> can be used repeatedly without loss of activity or N<sub>2</sub>F(+) salt formation. Cis-N<sub>2</sub>F<sub>2</sub> forms with SnF<sub>4</sub> at low temperatures a 2:1 salt, (N<sub>2</sub>F(+))<sub>2</sub>SnF<sub>6</sub>(2-), that slowly loses N<sub>2</sub>F<sub>2</sub> at room temperature to give N<sub>2</sub>F(+)SnF<sub>5</sub>(-). The crystal structure of H<sub>3</sub>NF(+) CF<sub>3</sub>SO<sub>3</sub>(-) was also determined and exhibits a relatively long N-F bond.

DTIC

*Nitrogen Compounds; Order-Disorder Transformations; Nitrogen Fluorides; Crystal Structure; Catalysts*

**20030011348** Space and Naval Warfare Systems Center, San Diego, CA USA

**Copper Chemistry, Toxicity, and Bioavailability and Its Relationship to Regulation in the Marine Environment Final Report**

Zirino, A.; Seligman, P. F.; Aug. 2002; 91p; In English; Original contains color images

Report No.(s): AD-A408862; SSC-TD-3140; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This document details issues addressed at a November 2000 workshop attended by Navy and regulatory representatives and scientific experts. Objectives discussed were (1) define Navy copper compliance issues, problems, and requirements; (2) define current status and future direction of Cu regulations; (3) further the understanding of the relationship between copper speciation,

bioavailability, and toxicity; (4) determine the state-of-the-science of the Cu free ion activity and biotic ligand models; and (5) develop a consensus on the maturity of free Cu ion activity and complexation capacity measurement capabilities.

DTIC

*Toxicity; Copper*

**20030011401** NASA Glenn Research Center, Cleveland, OH USA

**Studying Fires in Orbit: Combustion Module-2 (CM-2)**

Urban, David, NASA Glenn Research Center, USA; STS 107 Shuttle Press Kit: Providing 24/7 Space Science Research; Dec. 16, 2002, pp. 69-70; In English; Also announced as 20030011376; Original contains color illustrations

Report No.(s): NASA/FS-2002-06-070-MSFC; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Light a candle and it quickly forms the familiar teardrop shape caused by hot, spent air rising and cold, fresh air flowing in behind it to keep the fire going. But this airflow also obscures many of the fundamental processes that we need to understand if we are to fine tune the many ways we control combustion in manufacturing, transportation, heating, fire safety and pollution. Conducting combustion experiments in the microgravity environment of orbit eliminates gravitational effects and slows many combustion processes so they become easier to study. Almost everything about fires changes in microgravity, and many differences are counter-intuitive: Microgravity fires may spread faster upwind than downwind, opposite to the behavior seen on Earth; While fire in space is often weaker than on Earth, flames in microgravity can be sustained under more extreme conditions than flames on Earth; Turbulent flames, thought to be completely independent of gravitational influence, have doubled in size in microgravity conditions. Professor Gerard Faeth at the University of Michigan has said that these findings show that gravity has impeded the rational development of combustion science much as the atmosphere has impeded astronomy. To build on what we have learned from space about combustion, the STS-107 mission will re-fly the Combustion Module that flew on the Microgravity Sciences Laboratory 1 and 1R (STS-83 and -94) in 1997. Upgraded and designated CM-2, the module will accommodate three experiments, Laminar Soot Processes (LSP-2), Structure of Flame Balls at Low Lewis-number (SOFBALL-2), and Water Mist Fire Suppression Experiment (Mist). LSP-2 and SOFBALL-2 are reflights from the Microgravity Sciences Laboratory 1; Mist is a new experiment. They are detailed in separate fact sheets. CM-2 will complete the primary science plan for these investigations, and help set the stage for expanded, long-term experiments aboard the International Space Station with the Fluids and Combustion Facility that will be installed in Destiny, the U.S. lab module.

Author

*Combustion Physics; Microgravity; Spaceborne Experiments*

**20030011404** Colorado Univ., Boulder, CO USA

**Mechanics of Granular Materials-3 (MGM-3)**

Sture, Stein, Colorado Univ., USA; Alshibi, Khalid, Louisiana State Univ., USA; STS 107 Shuttle Press Kit: Providing 24/7 Space Science Research; Dec. 16, 2002, pp. 75-77; In English; Also announced as 20030011376; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Scientists are going to space to understand how earthquakes and other forces disturb grains of soil and sand. They will examine how the particle arrangement and structure of soils, grains and powders are changed by external forces and gain knowledge about the strength, stiffness and volume changes properties of granular materials at low pressures. The Mechanics of Granular Materials (MGM) experiment uses the microgravity of orbit to test sand columns under conditions that cannot be obtained in experiments on Earth. Research can only go so far on Earth because gravity-induced stresses complicate the analysis and change loads too quickly for detailed analysis. This new knowledge will be applied to improving foundations for buildings, managing undeveloped land, and handling powdered and granular materials in chemical, agricultural, and other industries. NASA wants to understand the way soil behaves under different gravity levels so that crews can safely build habitats on Mars and the Moon. Future MGM experiments will benefit from extended tests aboard the International Space Station, including experiments under simulated lunar and Martian gravity in the science centrifuge.

Author

*Spaceborne Experiments; Granular Materials; Microgravity; Mechanical Properties; Sands*

**20030011406** NASA Glenn Research Center, Cleveland, OH USA

**Great (Flame) Balls of Fire! Structure of Flame Balls at Low Lewis-number-2 (SOFBALL-2)**

Ronney, Paul, University of Southern California, USA; Weiland, Karen J., NASA Glenn Research Center, USA; STS 107 Shuttle Press Kit: Providing 24/7 Space Science Research; Dec. 16, 2002, pp. 80-81; In English; Also announced as 20030011376; Original contains color illustrations

Report No.(s): NASA/FS-2002-06-071-MSFC; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche



Everyone knows that an automobile engine wastes fuel and energy when it runs with a fuel-rich mixture. 'Lean' burning, mixing in more air and less fuel, is better for the environment. But lean mixtures also lead to engine misfiring and rough operation. No one knows the ultimate limits for lean operation, for 'weak' combustion that is friendly to the environment while still moving us around. This is where the accidental verification of a decades-old prediction may have strong implications for designing and running low-emissions engines in the 21st century. In 1944, Soviet physicist Yakov Zeldovich predicted that stationary, spherical flames are possible under limited conditions in lean fuel-air mixtures. Dr. Paul Ronney of the University of Southern California accidentally discovered such 'flame balls' in experiments with lean hydrogen-air mixtures in 1984 during drop-tower experiments that provided just 2.2 seconds of near weightlessness. Experiments aboard NASA's low-g aircraft confirmed the results, but a thorough investigation was hampered by the aircraft's bumpy ride. And stable flame balls can only exist in microgravity. The potential for investigating combustion at the limits of flammability, and the implications for spacecraft fire safety, led to the Structure of Flame Balls at Low Lewis-number (SOFBALL) experiment flown twice aboard the Space Shuttle on the Microgravity Sciences Laboratory-1 (MSL-1) in 1997. Success there led to the planned reflight on STS-107. Flame balls are the weakest fires yet produced in space or on Earth. Typically each flame ball produced only 1 watt of thermal power. by comparison, a birthday candle produces 50 watts. The Lewis-number measures the rate of diffusion of fuel into the flame ball relative to the rate of diffusion of heat away from the flame ball. Lewis-number mixtures conduct heat poorly. Hydrogen and methane are the only fuels that provide low enough Lewis-numbers to produce stable flame balls, and even then only for very weak, barely flammable mixtures. Nevertheless, under these conditions flame balls give scientists the opportunity to test models in one of the simplest combustion experiments possible. SOFBALL-2 science objectives include: Improving our understanding of the flame ball phenomenon; Determining the conditions under which flame balls exist; Testing predictions of flame ball lifetimes; Acquiring more precise data for critical model comparison.

Author

*Combustion Physics; Microgravity; Spaceborne Experiments; Flames*

**20030011410** Colorado School of Mines, Center for Commercial Applications of Combustion in Space (CCACS), Golden, CO USA

**Water Mist Fire Suppression Experiment (MIST)**

McKinnon, J. Thomas, Colorado School of Mines, USA; Abbud-Madrid, Angel, Colorado School of Mines, USA; Riedel, Edward P., Colorado School of Mines, USA; STS 107 Shuttle Press Kit: Providing 24/7 Space Science Research; Dec. 16, 2002, pp. 90-92; In English; Also announced as 20030011376; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Researchers are going to space to study how a water mist system puts out flames. The research is aimed at developing a commercially viable, water-based fire-fighting system. This system could replace the current fire-fighting chemicals including Halons, which are being banned because they damage Earth's ozone layer. This ban makes water, once again, the prime tool for fighting fire, since no other replacements have been found. How do you put out fires with water and still reduce or eliminate property damage? Fine water mists may be the answer on Earth as well as in the air on commercial and military planes and even on spacecraft. The STS-107 experiment that studies fine water mist fire suppression is sponsored by two companies -- MicroCool, in Palm Springs, Calif., and Arizona Mist Inc., in Gilbert, Ariz. They are working with the Center for the Commercial Applications of Combustion in Space (CCACS) -- one of NASA's 17 Commercial Space Centers that help industry conduct space experiments. Space may be the ideal place to examine how water interacts with flame. On Earth, gravity causes lighter, hotter air to rise -- creating air currents that make it difficult to study the combustion process and fire-fighting techniques. In microgravity -- the low-gravity environment created as the space shuttle orbits Earth -- these currents are reduced or eliminated. This allows scientists to study exactly what happens in the combustion process. For this experiment, scientists will observe how water droplets, like those in a fine fog, interact with a flame and extinguish it. These observations will help industry determine the optimum water concentration and water droplet size needed to suppress fires. The information can be used to improve models for designing the next generation of environmentally friendly, low-cost fire-fighting systems.

Author

*Fire Fighting; Mist; Spaceborne Experiments; Aerospace Technology Transfer; Technology Utilization; Microgravity*

**20030011455** Leninetz Holding Co., Hypersonic System Research Inst., Saint Petersburg, Russia

**Theoretical and Experimental Research of Capabilities of MHD Technology to Control Gas Flow with Non-Equilibrium Ionization Final Report, 2 Jul. 2001-2 Jul 2004**

May 10, 2002; 82p; In English; Original contains color images

Report No.(s): AD-A408793; No Copyright; Avail: Defense Technical Information Center (DTIC)

This report results from a contract tasking Leninetz Holding Company, NIPGS as follows: The purpose of the project is the theoretical and experimental research of capabilities of using of MHD technology to control gas flow with non-equilibrium



ionization. Cold gas flows will be considered, where thermal ionization of gas flow is negligible. The analysis of various methods of ionization will be carried out, and mathematical models of an ionizer and MHD generator will be developed. Requirements to ionizer, MHD generator and flow parameters at which self-sustained operational mode of ionizer and MHD generator is realized will be formulated. Possibilities of using of MHD control in gas-dynamical systems will be considered. Traditional use of MHD transformation of energy to produce electric power is well understood both theoretically and experimentally nowadays. Nontraditional use of MHD to control flow parameters and hence performance of gas-dynamical systems that include MHD system as a subsystem is not well understood. MHD interaction acts as bulk force and power upon flow and allows varying flow parameters. In this case no mechanical parts are used to control the flow parameters. Therefore, this method of control can be considered as a perspective one for gas-dynamical system with a fixed geometry especially for high enthalpy flows. As a possible range of application for MHD control, two types of gas-dynamical system can be considered: a) gas-dynamical systems which must ensure variable parameters of flow at outlet of system with fixed parameters at inlet of one and b) gas-dynamical systems which must ensure limited range of variation for some flow parameters at outlet of system with variable parameters at inlet. The main requirement to realize MHD influence on flow is flow conductivity. In most gas-dynamical systems thermal ionization of flow is inappreciable and therefore it is necessary to use methods of non-equilibrium plasma creation. Various methods

DTIC

*Ionization; Gas Flow; Fluid Mechanics; Ionized Gases; Gas Ionization; Flow Characteristics*

**20030011480** Universite Blaise Pascal, Aubiere, France

**International Workshop on the Physics of Light-Matter Coupling in Nitrides, 2, Book of Abstracts**

May 2002; 46p; In English; Book of Abstracts of the International Workshop on the Physics of Light-Matter Coupling in Nitrides - 2 held 25-30 May 2002 at Rithymnon, Crete, Greece

Contract(s)/Grant(s): N68558-02-M-5955

Report No.(s): AD-A408772; R/D-9278-EE-03; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This workshop is planned as a high-level scientific meeting connected to the Research Training Network "CLERMONT" (Physics of Light Matter Coupling in Nitrides) funded by the Commission of the European Community (Contract No. HPRN-CT-1999-OOI 32). This network is co-ordinated by Alexey Kavokin, professor of Solid State Physics at the University Blaise Pascal in Clermont-Ferrand (UBP-CF), France.

DTIC

*Abstracts; Nitrides; Pascal (Programming Language); Education*

**20030011488** Iowa State Univ. of Science and Technology, Dept. of Chemistry, Ames, IA USA

**Reactivity of Highly Excited Diatomic Ions in Hypersonic Nonequilibrium Flow Conditions Final Report, 1 May 1999-30 Nov. 2001**

Ng, Cheuk-Yiu; Dressler, Rainer A.; Oct. 23, 2002; 17p; In English

Contract(s)/Grant(s): F49620-99-1-0234; AF Proj. 2303

Report No.(s): AD-A408719; AFRL-SR-AR-TR-02-0370; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

During this funding cycle, we have constructed and successfully integrated a state-of-the-art guided-ion beam mass spectrometer into the high-resolution photoion-photoelectron apparatus (Endstation 2) of the Chemical Dynamics Beamline at the Advanced Light Source (ALS) for the study of ion-molecule reaction dynamics. Preliminary tests on the performance of this guided-ion beam mass spectrometer have been made, indicating that the ion-molecule reaction photoionization apparatus is performing well. We have also obtained preliminary results on the collision-induced dissociation (CID) and charge transfer (CT) cross sections for the reactions of  $O_2 + (v = 0-3) + Ar$ . We have also completed the analysis of the rotationally resolved pulsed field ionization (PFI)-photoelectron (PFI-PE) spectra for the formation of  $O_2+(X2II3/2, 1/2g; v = 0-38)$ ,  $O_2+(a4II5/2, 3/2, 1/2, -1/2u)$ ,  $O_2+(A2113/2, 1/2u, v = 0-12)$ ,  $NO+(X'E+, v = 0-32)$ , and  $NO+(A'E-, v = 0-17)$ . The information thus obtained about these states will be needed for ion internal state-selections of  $O_2 +$  and  $NO +$ . A synchrotron-based PFI-photoion (PFI-PI) detection scheme was demonstrated for rovibronic-state selection of  $112+$ . This method is equivalent to the PFI-PE-photoion coincidence (PFI-PEPICO) method and is potentially useful for internal state-selection of reactant ions. In order for this PFI-PI scheme to be applicable to state-selections of heavier ions, such as  $O_2 +$ ,  $N_2 +$ , and  $NO +$ , it is necessary to increase the dark gap of the synchrotron ring period to  $\approx 1$   $\mu s$ . This can be accomplished by using a slotted chopper wheel to chop the synchrotron beam. Using an electron impact ionization source, we have also examined the CID and CT channels of the  $O_2+(X2113/1, 1/2g; v+) + Ar$  (Ne) reactions.

DTIC

*Photoelectrons; Molecular Interactions; Ionic Reactions; Association Reactions*

**20030011489** Air Force Research Lab., Propulsion Directorate West, Edwards AFB, CA USA

**Kinetics of Formation of Cyclic C6 and Cyclic C8 and BJ<sub>Cn</sub>-J Clusters (J=0, 1, 2; n = 3-11) in Solid Argon**

Presilla-Marquez, J. D.; Harper, J.; Larson, C. W.; Jun. 24, 1999; 19p; In English; Presented at Gordon Research Conference on Physics and Chemistry of Matrix Isolated Species. Held at Plymouth State Coll., Plymouth, NH, 11-16 Jul. 1999

Contract(s)/Grant(s): Proj-2303

Report No.(s): AD-A408620; AFRL-PR-ED-TP-1999-0160; AFRL-PR-ED-TP-1999-0160; No Copyright; Avail: Defense Technical Information Center (DTIC)

Graphs featuring the kinetics of formation of cyclic C6 and C8 and B<sub>j</sub>C<sub>n</sub>-j clusters.

DTIC

*Reaction Kinetics; Solidified Gases; Annealing; Cyclic Compounds; Argon*

**20030011504** Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

**Hepta-Coordination: Synthesis and Characterization of the IOF5<sup>2-</sup> Dianion, an XOF5E Compound**

Christe, Karl O.; Wilson, William W.; Dixon, David A.; Boatz, Jerry A.; Jan. 06, 1999; 16p; In English; Prepared in collaboration with the Loker Hydrocarbon Research Inst., Univ. of Southern California, Los Angeles, CA, and the Environmental Molecular Sciences Laboratory, Pacific Northwest Natl. Laboratory, Richland, WA

Contract(s)/Grant(s): AQF Proj. 2303

Report No.(s): AD-A408589; AFRL-PR-ED-TP-1999-0037; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The new IOF5(sup 2-) dianion was prepared in the form of its cesium salt by heating stoichiometric amounts of CsF, I2O5 and IF5 to 162 deg C for 14 days. The white stable solid was characterized by vibrational spectroscopy. A normal coordinate analysis was carried out with the help of ab initio calculations at the HF/ECP/DZP level of theory and resulted in an excellent agreement between observed and calculated frequencies. The structure of IOF5(sup 2-) is that of a pentagonal bipyramid with five equatorial fluorine ligands, and an oxygen atom and one sterically active free valence electron pair occupying the two axial positions. The structure is very similar to that, previously established by vibrational spectroscopy and X-ray diffraction for isoelectronic XeOF5(-), and represents only the second example of a heptacoordinated XOF5E (E = free valence electron pair) main group species. The possible existence of the IOF6(3-) trianion is briefly discussed.

DTIC

*Anions; Iodine Compounds*

**20030011508** Air Force Research Lab., Propulsion Directorate West, Edwards AFB, CA USA

**A New Synthesis of Fluorine Nitrate**

Hoge, B.; Christe, K. O.; Oct. 11, 2000; 7p; In English; Prepared in cooperation with Loker Hydrocarbon Research Institute, University of Southern California, Los Angeles, CA

Contract(s)/Grant(s): AF Proj. 2303

Report No.(s): AD-A408583; AFRL-PR-ED-TP-2000-192; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The reaction of NF4(+)SbF6(-) with alkali metal nitrates in either CH3CN or SO2 solution at low temperature produces FONO2 in quantitative yield. Attempts were unsuccessful to prepare FONO from NF4SbF6 and KNO2 in an analogous manner.

DTIC

*Fluorine Compounds; Nitrates; Synthesis (Chemistry)*

**20030011509** Air Force Research Lab., Propulsion Directorate West, Edwards AFB, CA USA

**On the Existence of the Halocarbonyl and Trifluoromethyl Cations in the Condensed Phase**

Christe, K. O.; Hoge, B.; Boatz, J. A.; Prakash, G. K.; Olah, G. A.; Jan. 06, 1999; 37p; In English; Prepared in cooperation with Loker Hydrocarbon Research Institute, University of Southern California, Los Angeles California

Contract(s)/Grant(s): AF Proj. 2303

Report No.(s): AD-A408582; AFRL-PR-ED-TP-FY99-0038; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Vibrational and multinuclear NMR (nuclear magnetic resonance) spectroscopy were used to reexamine previous claims, which were based solely on C-13-NMR spectra, for the existence of the FCO(+) and ClCO(+) cations in the condensed phase. The previously reported C-13-NMR signal, observed in the photolytic ionization of tert-butyl fluoro-formate and attributed to FCO(+), could not be reproduced. Furthermore, there was no evidence for the formation of FCO(+), when F2CO was reacted either with solid SbF5 matrices or with AsF5 or SbF5 in SO2ClF solutions at low-temperatures. The only observable products were the known oxygen-bridged donor-acceptor adducts between F2CO and the Lewis acids. Similarly, for Cl2CO or ClFCO and stoichiometric amounts of Lewis acids, only the corresponding oxygen-bridged donor-acceptor adducts were observed. However, in the presence of a two-fold excess of SbF5, the thermally unstable, ionic salt, ClCO(+) Sb3F(16), could be isolated. The ClCO(+)

cation was characterized by vibrational spectroscopy and theoretical calculations. Frenking's natural bond orbital (NBO) analysis for  $\text{CF}_3(+)$  and related species, which contain only one type of  $\text{p}(\pi)$  back-donating ligands, was extended to systems containing two types of competing,  $\text{p}(\pi)$  back-donating ligands. It is shown that  $\text{p}(\pi)$  back-donation increases in the order  $\text{F} < \text{Cl} \leq \text{I}$  for the  $\text{XCO}(+)\text{X}=\text{F}$  or  $\text{Cl}$  cations, resulting in C-O triple bonds, while sigma-donation suppresses generation of a positive charge on oxygen. Born-Haber cycles were calculated for the  $\text{SbF}_6(-)$  salts of  $\text{CF}_3(+)$ ,  $\text{FCO}(+)$ , and  $\text{ClCO}(+)$ , as well as  $\text{ClCO}(+)\text{Sb}_3\text{F}_{16}(-)$ . These cycles demonstrate that unfavorable overall thermodynamics, rather than  $\text{p}(\pi)$  back-donation, are the main reasons for the elusiveness of  $\text{CF}_3(+)$  and  $\text{FCO}(+)$  salts in the condensed phase. For the  $\text{F}_2\text{CO}/\text{SbF}_5$  system, the overall thermodynamics are also responsible for the preferential formation of an oxygen-bridged donor-acceptor adduct.

DTIC

*Carbonyl Compounds; Fluorine Compounds; Vibrational Spectra; Cations; Halocarbons*

**20030011549** Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

**Isolation of Carbon Atoms in Cryogenic Solids**

Harper, J.; Sheehy, J. A.; Larson, C. W.; Apr. 30, 1998; 15p; In English

Contract(s)/Grant(s): Proj-2303

Report No.(s): AD-A408624; AFRL-PR-ED-TP-1998-096; AFRL-PR-ED-TP-1998-096; No Copyright; Avail: Defense Technical Information Center (DTIC)

Briefing notes and graphs featuring research on the isolation of carbon atoms in cryogenic solids presented at the AFOSR HEDM Contractor's Conference, held in Monterey, CA, 20-22 May 1998.

DTIC

*Conferences; Carbon; Cryogenics; Solid Phases; Atoms*

**20030011550** Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

**CO/pH<sub>2</sub> - A Molecular Thermometer**

Tam, Simon; Fajardo, Mario E.; Apr. 30, 1998; 21p; In English

Contract(s)/Grant(s): Proj-2303

Report No.(s): AD-A408625; AFRL-PR-ED-TP-1998-091; AFRL-PR-ED-TP-1998-091; No Copyright; Avail: Defense Technical Information Center (DTIC)

We utilize reversible temperature dependent changes in the infrared absorption spectrum of CO molecules in solid parahydrogen (pH<sub>2</sub>) to probe the temperature profiles of the matrices during deposition. The intensity of a well-resolved absorption feature near 2135  $\text{cm}^{-1}$  shows monotonic increase with temperature over the 2 to 5 K range. The initial state of this transition is estimated to be 7.9(+/-0.5) K above the ground state of CO/pH<sub>2</sub>. During the deposition of 100 PPM CO/pH<sub>2</sub> samples, we detect temperature gradients of appr. 10 K/cm in samples subjected to estimated heat loads of appr. 10 mW/cm<sup>2</sup>. The resulting estimated thermal conductivities of appr. 1 mW/cm-K (0.1 W/M-K) are four orders of magnitude lower than the conductivity of single crystal solid pH<sub>2</sub>, and more than an order of magnitude lower than previously measured for pH<sub>2</sub> solids doped with 100 PPM concentrations of heavy impurities.

DTIC

*Para Hydrogen; Solid Cryogens; Solidified Gases; Carbon Monoxide; Thermometers*

**20030011551** Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

**An Ortho/Para Hydrogen Converter for Rapid Deposition Matrix Isolation Spectroscopy**

Tam, Simon; Fajardo, Mario E.; Sep. 30, 1998; 28p; In English

Contract(s)/Grant(s): Proj-2303

Report No.(s): AD-A408626; AFRL-PR-ED-TP-1998-168; AFRL-PR-ED-TP-1998-168; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We describe the construction and operation of a catalyst-bed type device for precooling and equilibrating the ortho/para composition of a hydrogen gas flow. We use this device to vapor deposit millimeters thick cryogenic parahydrogen (pH<sub>2</sub>) solids which are remarkably transparent M.E. Fajardo and S. Tam, J. Chem. Phys. 108, 4237 (1998). Infrared absorption spectra of solids deposited at pH<sub>2</sub> flow rates up to 290 mmol/hour (solid thickness growth rates up to 75  $\mu\text{m}/\text{min}$ ) indicate a residual orthohydrogen (oH<sub>2</sub>) content of less than 0.01%. Gas phase thermal conductivity measurements indicate a residual oH<sub>2</sub> content of 0(+5/-0)% for flow rates up to 1.9 mol/hour. These pH<sub>2</sub> solids can be doped readily by simple co-deposition of various impurities produced by any of the numerous dopant sources developed in previous matrix isolation spectroscopy (MIS) studies. The long achievable

pathlengths, and the desirable properties of p<sub>H2</sub> as a matrix host, will enable revolutionary new fundamental and practical applications for MIS.

DTIC

*Cryogenics; Deposition; Ortho Hydrogen; Para Hydrogen; Spectroscopy; Converters*

**20030011552** Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

**Kinetics of Boron Carbon HEDM**

Larson, C. W.; May 28, 1999; 16p; In English; at HEDM Contractors' Conf. Held in Cocoa Beach, FL, 7-11 Jun 1999

Contract(s)/Grant(s): Proj-2303

Report No.(s): AD-A408627; AFRL-PR-ED-TP-1999-0113; AFRL-PR-ED-TP-1999-0113; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The objective of this research is the development and characterization of a boron atom source.

DTIC

*Boron; Carbon; Kinetics; High Energy Propellants*

**20030011553** Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

**Bicyclopopylidene and 1,5-Hexadiyne from Bench Scale to Pilot Scale: Problems and Solutions**

Suri, Suresh C.; Tinnirello, Michael; May 28, 1999; 28p; In English

Contract(s)/Grant(s): Proj-2303

Report No.(s): AD-A408629; AFRL-PR-ED-TP-1999-0122; AFRL-PR-ED-TP-1999-0122; No Copyright; Avail: Defense Technical Information Center (DTIC)

The goal of this research is to come up with a fuel with a 2 to 5% increase of Isp over LOX/RP-1.

DTIC

*Hydrocarbons; Synthesis (Chemistry); RP-1 Rocket Propellants*

**20030011556** Air Force Research Lab., Propulsion Directorate West, Edwards AFB, CA USA

**Computational Chemistry and Materials Science CTA**

Perkins, Leslie S.; May 18, 2000; 12p; In English

Contract(s)/Grant(s): Proj-2303

Report No.(s): AD-A408634; AFRL-PR-ED-TP-2000-117; AFRL-PR-ED-TP-2000-117; No Copyright; Avail: Defense Technical Information Center (DTIC)

Viewgraphs for presentation given on computational chemistry and materials science research.

DTIC

*Computational Chemistry; Materials Science; Molecular Dynamics; Quantum Mechanics*

**20030011562** Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

**High Resolution Infrared Spectroscopy in Doped Parahydrogen (p<sub>H2</sub>) Solids: CO/p<sub>H2</sub> - A Molecular Thermometer**

Fajardo, Mario E.; Tam, Simon; Apr. 11, 2000; 4p; In English; Pres. at Cryocrystals 2000 Conference. Held in Szklarska Poreba, Poland, 28 Jul-4 Aug 2000

Contract(s)/Grant(s): Proj-2303

Report No.(s): AD-A408650; AFRL-PR-ED-AB-2000-064; AFRL-PR-ED-AB-2000-064; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

We have developed an alternative doped solid p<sub>H2</sub> preparation technique based on rapid vapor deposition of precooled p<sub>H2</sub> gas onto a substrate-in-vacuum at T = 2 K. The resulting millimeters-thick samples are remarkably transparent, even capable of escaping casual visual detection; in sharp contrast to previously described "completely opaque brown-black" vapor deposited hydrogen solids. Our co-deposition geometry enables us to trap dopant species produced by a wide variety of methods, with excellent isolation efficiencies even at dopant concentrations exceeding 100 PPM. The excellent optical properties of our samples permit their spectroscopic interrogation at wavelengths from the vacuum ultraviolet to the mid-IR. The long useful pathlengths enables the detection of low concentration or weakly absorbing species.

DTIC

*Doped Crystals; Infrared Spectroscopy; Solids; Thermometers; High Resolution; Para Hydrogen; Carbon Monoxide*



26  
**METALS AND METALLIC MATERIALS**

*Includes physical, chemical, and mechanical properties of metals and metallic materials; and metallurgy.*

**20030007729** Swedish Defence Research Establishment, Weapons and Protection Div., Tumba Sweden

**Characterization/Simulation of Hard Metal Projectiles. Progress Report** *Karakterisering/Simulering av Hardmetallprojektiler. Laegsrapport*

Niulsson, M.; Westerling, L.; Skoglund, P.; Dec. 2001; 26p; In Swedish

Report No.(s): PB2003-101008; FOI-R-0296-SE; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Small caliber armour piercing projectiles have a core made of hardened steel or tungsten carbide (WC). The WC core results in very high penetration and a study of protection against this threat is of high priority. When continuum mechanical calculations are made there is a need for material models to describe the behavior of this kind of materials and material data describing WC. WC is a very hard material and shows no plastic strain in tension or bending. At the high pressure signifying penetration of armour materials, the projectile will deform plastically. In this initial report, methods for testing and simulating of hard and brittle materials like WC, other hard metal composites and ceramic materials are discussed. In the report, there is a brief description of methods of compressive, shear and hardness testing of hard and brittle materials. A more thorough description is made of the chosen testing method-dynamic indentation-and how data from indentation testing can be used to develop constitutive relationships. A brief compilation of some relevant material models is done. Future work will consist of verifying the testing method with metallic materials for example steel and aluminium. Thereafter testing of hard and brittle materials like WC will be done. Material relationships are implemented in a suitable material model and the calculations are verified against ballistic tests.

NTIS

*Tungsten Carbides; Projectiles*

**20030011301** Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

**Physical and Chemical Characterization of Ultrafine Aluminum Powders**

Ismail, I. M.; Hawkins, T. W.; Oct. 07, 1999; 35p; In English

Report No.(s): AD-A408575; AFRL-PR-ED-TP-1999-0184; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Compared to regular aluminum powders, ultra fine aluminum UFAI enhances the burning rate of propellants. Smaller UFAI particles have a large surface area which enhances the burning rate; they also have a large percentage of Al(2)O(3) which reduces the ISP of the propellants.

DTIC

*Aluminum; Powdered Aluminum*

**20030011338** Army Research Lab., Aberdeen Proving Ground, MD USA

**Surface Heating of Molybdenum, Tantalum, and Tungsten Rods by Pulsed Currents** *Final Report*

Hummer, Charles R.; Powell, John D.; Berning, Paul R.; Nov. 2002; 40p; In English; Original contains color images

Contract(s)/Grant(s): 1L161102AH43

Report No.(s): AD-A408815; ARL-TR-2843; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Measurements of the surface voltage and surface temperature are made for small molybdenum, tantalum, and tungsten rods that have been subjected to pulsed electrical heating. The heating time is from 100 to 200 microseconds. The experimental results are then compared to results obtained from calculations undertaken with a numerical model that accounts for diffusion of current and ohmic heating within the sample. Good agreement between theory and experiment is obtained for the voltages and the temperatures. This agreement (a) provides valuable confirmation of the theoretical models and the experimental techniques used in Army applications of pulsed power; (b) demonstrates that the thermophysical properties of these substances are not affected by the rapid heating rates necessary in those applications; and (c) suggests a coupled experimental and theoretical technique for measuring resistivity in substances for which that property is not well known. The methodology for measuring the resistivity is developed and demonstrated in a sample experiment and calculation.

DTIC

*Rods; Electric Current; Surface Temperature; Electrical Resistivity; Electric Potential*



## 27 NONMETALLIC MATERIALS

*Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials. For composite materials see 24 Composite Materials.*

**20030007771** Office of Air Quality Planning and Standards, Research Triangle Park, NC USA

**Economic Impact Analysis of the Final Reinforced Plastics NESHAP Final Report**

Aug. 2002; 134p; In English; Also available on CD-ROM

Report No.(s): PB2003-101921; EPA/452/R-02/007; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The Clean Air Act's (CAA's) purpose is to protect and enhance the quality of the nation's air resources (Section 101(b)). Under the authority of Section 112 of the CAA as amended in 1990, the U.S. Environmental Protection Agency (EPA or the Agency) is currently developing a National Emission Standard for Hazardous Air Pollutants (NESHAP) to reduce emissions generated during the production of reinforced plastic composites (RPCs). This report evaluates the economic impacts of three regulatory alternatives that are designed to control these releases.

NTIS

*Reinforced Plastics; Economic Impact; Emission; Air Pollution; Air Quality*

**20030007841** United Space Alliance, SRB Loads and Aerothermal Analysis Group, Cape Canaveral, FL USA

**Recession Curve Generation for the Space Shuttle Solid Rocket Booster Thermal Protection System Coatings**

Kanner, Howard S., United Space Alliance, USA; Stuckey, C. Irvin, United Space Alliance, USA; Davis, Darrell W., NASA Marshall Space Flight Center, USA; Jun. 24, 2002; 5p; In English; 8th AIAA/ASME Joint Thermophysics and Heat Transfer Conference, 24-27 Jun. 2002, Saint Louis, MO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): NAS9-20000

Report No.(s): AIAA Paper 2002-3334; Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Distribution under U.S. Government purpose rights under contract number NAS9-20000; Distribution under U.S. Government purpose rights under contract number NAS9-20000

Ablatable Thermal Protection System (TPS) coatings are used on the Space Shuttle Vehicle Solid Rocket Boosters in order to protect the aluminum structure from experiencing excessive temperatures. The methodology used to characterize the recession of such materials is outlined. Details of the tests, including the facility, test articles and test article processing are also presented. The recession rates are collapsed into an empirical power-law relation. A design curve is defined using a 95-percentile student-t distribution, based on the nominal results. Actual test results are presented for the current acreage TPS material used.

Author

*Space Shuttle Boosters; Thermal Protection; Coatings*

**20030010467** Naval Air Systems Command, Patuxent River, MD USA

**Study of Brayco Corrosion Inhibitor Additive in MIL-PRF-23699 Class C/I turbine Oil Final Report, 1 Oct. 2001-1 Jul. 2002**

Thorsen, Michael R.; Shimski, John T.; Aug. 02, 2002; 23p; In English; Original contains color images

Contract(s)/Grant(s): N00019-02-WXB-614R

Report No.(s): AD-A408697; NAVAIRSYSCOM-445/02-003; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Various performance tests were conducted on aviation turbine engine oil, MIL-PRF-23699 Class C/I, to determine the impact of adding a specific after-market corrosion inhibitor, Brayco 599. The additive was tested at six concentrations between 0 and 10%. Test results indicated a 7% concentration of the additive significantly reduced the load carrying capacity of the lubricant in three out of four tests which measure this property. In addition, High Temperature Deposition testing indicated the potential for deposition problems with 7% or higher concentrations of the additive.

DTIC

*Lubricants; Load Carrying Capacity; Oils; Additives*

**20030011254** Limerick Univ., Limerick, Ireland

**VARTM and RTM Processing of PBT and PA Thermoplastic Composites Final Report, 16 Mar. 2001-30 Jun. 2002**

Mallon, P. J.; Dweib, M. A.; Ziaee, S.; Chatterjee, A.; Gillespie, J. W.; Oct. 30, 2002; 119p; In English; Original contains color images; -Original contains color plates: All DTIC reproductions will be in black and white. Prepared in cooperation with National University of Ireland, Galway, Ireland and Delaware Univ., Center for Composite Materials, Newark

Contract(s)/Grant(s): N00014-01-1-0509

Report No.(s): AD-A408706; Rept-3-3-21-3144-FINAL; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Vacuum assisted resin transfer molding (VARTM) and resin transfer molding (RTM) processes have been successfully developed to enable infusion of thermoplastic pre-polymers into glass and carbon fiber performs at temperatures up to 210 deg C. The pre-polymers used in this study were CBT (Cyclic Butylene Teraphthalate oligomer) leading to a PBT composite, APLC-12 (Anionically-Polymerised Lactam -12) leading to a PA-12 composite, and APLC-6 (Anionically-Polymerised Lactam -6) leading to a PA-6 composite. Mixtures of PA-12 and PA-6 were also examined. Traditionally it has not been easy to mold thermoplastic-reinforced composites due to their high viscosities. High temperatures and pressures were always required to fully impregnate fiber beds. Liquid composite molding processes, such as those demonstrated in this report, were virtually impossible. The employment of an activated pre-polymer melts eliminates the problems associated with high viscosity. All of the materials processed here were using vacuum pressure only.

DTIC

*Vacuum; Resin Transfer Molding; Composite Structures*

**20030011351** Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA

**Kevlar KM2 Yarn and Fabric Strength Under Quasi-Static Tension** *Final Report, Mar. 2001-Apr. 2002*

Mulkern, Thomas J.; Raftenberg, Martin N.; Oct. 2002; 34p; In English

Contract(s)/Grant(s): Proj-1L162619AH80

Report No.(s): AD-A408883; ARL-TR-2865; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Kevlar KM2, 600 denier, was Instron tested in quasi-static, uniaxial tension to determine its strength. Specimens included both single yarns and 68-yarn-wide, single-ply strips of plain-woven fabric (Style 706). Never-woven single-yarn specimens were tested with varying degrees of initial twist. Strength of the untwisted, never-woven yarn was  $2.66 \pm 0.04$  GPa. The twist multiplier was 1.2. Single warp-oriented and fill-oriented yarns were extracted from Style 706 fabric, tested, and found to have strengths of  $2.06 \pm 0.01$  and  $2.20 \pm 0.05$  GPa, respectively. The single-ply fabric specimens of both warp and fill orientations were tested and found to have strengths of  $2.23 \pm 0.04$  and  $2.67 \pm 0.04$  GPa, respectively. The strength effects of weaving, finishing, yarn extraction, and inter-yarn contact are discussed.

DTIC

*Fabrics; Matrices (Mathematics)*

**20030011354** Washington Univ., Dept. of Chemistry, Seattle, WA USA

**Advanced Organic Electro-Optic Materials for Integrated Device Applications** *Final Report, 1 Jul. 1999-30 Jun. 2001*

Dalton, Larry D.; Jun. 2001; 6p; In English

Contract(s)/Grant(s): F49620-99-1-0287

Report No.(s): AD-A408887; AFRL-SR-BL-TR-02-0156; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Electro-optic chromophores (FTC and CLD) were synthesized in bulk (kilogram) quantities and were distributed to the participants of this program project (Steier, Fetterman, Chen, and TACAN/IPITEK). They were also provided to other Department of Defense programs including to researchers at China Lake (Navy), Redstone Arsenal (Army), and Wright Paterson (Air Force Research Laboratory) and to various industrial programs (e.g., Lockheed Martin) participating in DoD research programs. FTC and CLD chromophores were systematically modified to improve their properties, including for lattice hardening to stabilize electro-optic activity for operation at elevated temperatures and photon flux levels. Over 100 variants of these chromophores were synthesized and were evaluated. Reaction yields were optimized by systematic variation of reaction conditions. New chromophores were also synthesized at the University of Washington including those involving incorporation of significantly improved chromophores. These new materials involve factors of 1.5-2.0 improvement over FTC and CLD chromophores in terms of electro-optic activity at telecommunication wavelengths. They also have proven more amenable to being processed into hardened material lattices and have exhibited significantly improved thermal and photochemical stability. The role of chromophore structure and the use of radical (and singlet oxygen) scavengers have been investigated. The results can be utilized to fabricate materials with significantly improved photochemical stability.

DTIC

*Optical Materials; Organic Materials; Computer Networks; Electro-Optics*

**20030011355** Army Armament Research, Development and Engineering Center, Benet Weapons Lab., Watervliet, NY USA

**In-Situ Phase Evolution study in Magnetron-Sputtered Tantalum Thin Films** *Final Report*

Lee, S. L.; Windover, D.; Lu, T. M.; Audino, M.; Oct. 2002; 23p; In English

Report No.(s): AD-A408894; ARCCB-TR-02014; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The design and construction of a planar magnetron-sputter deposition system with a beryllium chamber was accomplished to perform in-situ x-ray diffraction growth study of refractory coatings. The deposition system was set on top of a laboratory 26 x-ray diffractometer. A two-dimensional array detector was interfaced for observation of the Debye rings during growth. Integration along the 20 and directions allows fast phase and texture determination. The system was built to study effects of sputter deposition parameters on the structural properties of tantalum on steel, silicon, and glass substrates without exposing the system to atmosphere pressure. Two sputter depositions of tantalum films onto glass substrate in argon gas are reported here, one was deposited at 25-mm target-detector distance, 3.9 Pascal argon gas, and the other at 108-mm target-detector distance and 1.3 Pasc% argon gas. The first film grew to 250-nm in 39 minutes at an average growth rate of 6.4-nm/minute. It consisted of 45-nm of interface layer, which showed no crystalline structure, and was most likely amorphous film. It was followed by 15-nm growth of Beta-tantalum, and then followed by 190-nm growth of alpha-tantalum. From the full-width half maximum of the plot, it was determined that the p-tantalum region was is less than 002> textured, and the a-tantalum region was is less than 110> textured, and grew more textured with deposition time. The second film grew to 36-nm in 22 minutes at an average growth rate of 1.6-nm/minute. It consisted of 31-nm of layer, which showed no crystalline structure, and was most likely amorphous film. It was followed by 5-nm of surface layer of p- and a-tantalum. Ex-situ grazing incidence x-ray diffraction performed on the film surface confirmed the in-situ results. Ex-situ pole figure analysis showed is less than 110> fiber texture in a- tantalum, and highly is less than 002> texture in p-tantalum.

DTIC

*Tantalum; Sputtering; Physical Properties*

**20030011479** Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

**Polyhedral Oligomeric Silsesquioxanes (POSS): Silicon Based Monomers and Their Use in the Preparation of Hybrid Polyurethanes**

Schwab, Joseph J.; Lichtenhan, Joseph D.; Chaffee, Kevin P.; Mather, Patrick T.; Romo-Urbe, Angel; May 05, 1998; 8p; In English

Report No.(s): AD-A408813; AFRL-PR-ED-TP-1998-083; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A series of Polyhedral Oligomeric Silsesquioxane (POSS) monomers bearing reactive hydroxyl functionalities, suitable for incorporation into step-growth polymers, is described. These monomers are difunctional in nature and are particularly well suited for use as chain extenders in the synthesis of polyurethanes. This work describes the synthesis of these POSS and their incorporation into a series of polyurethanes. Preliminary thermal, mechanical and rheological data for the POSS containing polyurethanes will also be discussed.

DTIC

*Silicon; Monomers; Reactivity*

**20030011540** Arizona Board of Regents, Mesa, AZ USA

**Photon-Gated Photorefractive Polymers Final Report, 1 Mar. 1999-31 Aug. 2002**

Peyghambarian, Nasser; Kippelen, Bernard; Oct. 24, 2002; 11p; In English

Contract(s)/Grant(s): F49620-99-01-0021; AF Proj. 2303

Report No.(s): AD-A408893; FRS 311800; AFRL-SR-AR-TR-02-0369; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The goal of this program on Photorefractive polymers are to improve the performance of Photorefractive polymers and to fabricate innovative devices based on these highly efficient materials. During the lifespan of the program we have made significant progress in the following areas: (1) material fabrication and characterization, (2) modeling of photorefractivity in polymers and (3) development of new applications based on photorefractive polymers. During the course of the investigation we published (with AFOSR acknowledgments) 12 papers in refereed journals and 5 book chapters and gave 32 invited talks at international conferences and workshops.

DTIC

*Polymers; Photons; Photorefractivity; Fabrication*

**20030011554** Massachusetts Univ., Dept. of Polymer Science and Engineering, Amherst, MA USA

**Drawing Behavior of Ultrahigh Molecular Weight Polyethylene (UHMWPE) Fibers in Supercritical CO<sub>2</sub> Final Report, Jul. 2000-Jul 2001**

Lesser, Alan J.; Nov. 2002; 29p; In English; Original contains color images

Contract(s)/Grant(s): DAAD16-00-P-0769

Report No.(s): AD-A408631; 5-28101; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The drawing behavior of Ultrahigh Molecular Weight Polyethylene (UHMWPE) fibers in supercritical CO<sub>2</sub> (scCO<sub>2</sub>) is compared to that in air at different temperatures. Temperature substantially influences the drawing properties in air, while in scCO<sub>2</sub> a constant draw stress and tensile strength are observed. Differential Scanning Calorimetry (DSC) shows an apparent development of a hexagonal phase along with significant improvements in crystallinity of air-drawn samples with increasing temperature. The existence of this phase is not confirmed by WIDE ANGLE X-RAY SCATTERING (WAXS) showing that air-drawn samples crystallize in an internally constrained manner. In contrast, scCO<sub>2</sub> allows crystals to grow without constraints through a possible crystal-crystal transformation, increasing the processing temperature to 110 C.

DTIC

*Carbon Dioxide; Molecular Weight; Polyethylenes; Synthetic Fibers; Heat Measurement; Supercritical Flow*

## 28

### PROPELLANTS AND FUELS

*Includes rocket propellants, igniters and oxidizers; their storage and handling procedures; and aircraft fuels. For nuclear fuels see 73 Nuclear Physics. For related information see also 07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, and 44 Energy Production and Conversion.*

**20030011260** Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

#### **Theoretical Study of the Mechanism of the Decomposition Process of High Energy Density Materials**

Yoo, Hi Young; Boatz, Jerry; Apr. 30, 1998; 10p; In English; Abstract and viewgraphs only

Contract(s)/Grant(s): AF Proj. 2303

Report No.(s): AD-A408612; AFRL-PR-ED-TP-1998-090; No Copyright; Avail: Defense Technical Information Center (DTIC)

One of the goals of the HEDM program is the development of high performance monopropellants which are also less toxic than currently used systems such as hydrazine. Included in this effort is the characterization of decomposition mechanisms, as an initial step toward identification of a suitable catalyst. Ab initio quantum mechanical calculations are performed on the decomposition mechanisms of NH<sub>2</sub>Me<sub>2</sub>+NO<sub>3</sub>%, a potential monopropellant replacement for hydrazine. The potential energy surfaces of two gas-phase decomposition processes have been explored: (1) proton transfer and (2) methyl cation transfer reactions. These reaction pathways have been examined for both the isolated cation NH<sub>2</sub>Me<sub>2</sub> + and in the presence of a counter anion, X=Cl, NO<sub>3</sub>. For X=Cl, transition states for both pathways have been located at the RHF/6-31G\* level and the corresponding intrinsic reaction coordinates (IRCs) have been traced. Comparison of activation barriers and reaction enthalpies for these gas-phase decomposition pathways will be presented here.

DTIC

*Decomposition; Nitrogen Compounds; Quantum Mechanics; Monopropellants; Hydrazines*

**20030011261** Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

#### **Solid Parahydrogen**

Fajardo, Mario E.; Tam, Simon; Apr. 30, 1998; 43p; In English; Briefing notes only

Contract(s)/Grant(s): AF Proj. 2303

Report No.(s): AD-A408611; AFRL-PR-ED-TP-1998-097; No Copyright; Avail: Defense Technical Information Center (DTIC)

Briefing charts for presentation given at High Energy Density Matter Contractors Conference. Held in Monterey, CA, 20-22 May 1998.

DTIC

*Solid Propellants; Para Hydrogen; Solid Cryogenics; Solidified Gases*

**20030011263** Air Force Research Lab., Propulsion Directorate West, Edwards AFB, CA USA

#### **Identification and Condensation of Cyclic C<sub>6</sub> and Cyclic C<sub>8</sub> in Solid Argon Characterization of Matrix Isolated BjCn-j J=0, 1, 2; n=3-11 in Solid Argon**

Larson, C. W.; Jun. 08, 1999; 30p; In English; Briefing charts only

Contract(s)/Grant(s): AF Proj. 2303

Report No.(s): AD-A408605; AFRL-PR-ED-TP-1999-0107; No Copyright; Avail: Defense Technical Information Center (DTIC)



Graphs of identification and condensation of cyclic C6 and cyclic C8 in solid argon, and the characterization of matrix isolated BjCn-j in solid argon.

DTIC

*Carbon; Cyclic Compounds; Solidified Gases*

**20030011264** Air Force Research Lab., Space and Missile Propulsion, Edwards AFB, CA USA

**New Energetic Salts for Monopropellants**

Drake, Greg; Brand, Adam; McKay, Milton; Ismail, Ismail; Hawkins, Tom; Jun. 09, 1999; 35p; In English; Viewgraphs only. Prepared in collaboration with ERC, Inc., Edwards AFB, CA. Pres. at U.S. Air Force High Energy Density Materials Meeting, 9 Jun 1999

Contract(s)/Grant(s): AF Proj. 2303

Report No.(s): AD-A408604; AFRL-PR-ED-TP-1999-0109; No Copyright; Avail: Defense Technical Information Center (DTIC)

Presentation includes research on 2-hydroxyethylhydrazine salts, dimethyltriazanium salts revisited; and energetic nitrocyamide salts.

DTIC

*Nitrogen Compounds; Monopropellants*

**20030011266** Air Force Research Lab., Space and Missile Propulsion, Edwards AFB, CA USA

**Cryosolid Propellants: The Last "Revolutionary" HEDM Concept**

Fajardo, Mario E.; Jun. 01, 1999; 29p; In English; Viewgraphs only. Pres. at High Energy Density Matter Contractors Conf. Held in Cocoa Beach, FL, 8-11 Jun 1999

Contract(s)/Grant(s): AF Proj. 2303

Report No.(s): AD-A408602; AFRL-PR-ED-TP-1999-0111; No Copyright; Avail: Defense Technical Information Center (DTIC)

Conference presentation on cryosolid propellants as high energy density materials, including 'revolutionary' vs. 'evolutionary' HEDMs; HEDM cryosolid propellants, and Air Force Research Lab experiments on HEDM dopant source development, dopant source characterization, and cryosolids characterization.

DTIC

*High Energy Propellants; Cryogenic Rocket Propellants*

**20030011318** Engineering Research and Consulting, Inc., Edwards AFB, CA USA

**Synthesis and Structural Characterization of Nitrogen Containing High Energy Density Materials**

Christe, Karl O.; Vij, Ashwani; Vij, Vandana; Wilson, William W.; Tham, Fook S.; Jun. 18, 2002; 3p; In English; International Congress/International Union of Crystallography, 6-15 Aug. 2002, Geneva, Switzerland; Prepared in cooperation with Loker Hydrocarbon Research Inst., Univ. of Southern California, Los Angeles, CA, and Dept. of Chemistry, Univ. of California, Riverside, CA, and Propulsion Directorate and Advanced Concepts Div., Air Force Research Lab.

Contract(s)/Grant(s): F04611-99-C-0025; AF Proj. DARPA

Report No.(s): AD-A408673; AFRL-PR-ED-AB-2002-146; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

In this paper we report the crystal structures of the novel N5<sup>+</sup> cation in N5<sup>+</sup>Sb2F11<sup>-</sup>, which is the first stable polynitrogen species to be discovered in a century since the discovery of the azide ion.

DTIC

*Synthesis (Chemistry); Nitrogen Compounds*

**20030011322** Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

**High Energy Density Materials: Synthesis and Characterization of the Pentanitrogen (1+) Cation, N5<sup>+</sup>, a Novel Homoleptic Polynitrogen Ion**

Christe, Karl O.; Wilson, William W.; Sheehy, Jeffrey A.; Boatz, Jerry A.; May 12, 1999; 24p; In English; Prepared in collaboration with the Loker Hydrocarbon Research Inst., Univ. of Southern California, Los Angeles, CA

Contract(s)/Grant(s): AF Proj. 2303

Report No.(s): AD-A408655; AFRL-PR-ED-TP-1999-0075; No Copyright; Avail: Defense Technical Information Center (DTIC)



Polynitrogen compounds are of significant interest as high energy density materials (HEDM) for propulsion or explosive applications. In spite of numerous theoretical studies predicting that certain all-nitrogen compounds might be stable, however, only a few unsuccessful experimental studies aimed at their actual synthesis have been undertaken.

DTIC

*Synthesis (Chemistry); Nitrogen Compounds*

**20030011327** Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

**Theory and Synthesis of New High Energy Density Materials**

Christe, Karl O.; Wilson, William W.; Drake, Greg W.; Sheehy, Jeff A.; Boatz, Jerry A.; Apr. 30, 1998; 19p; In English; Prepared in collaboration with Loker Hydrocarbon Research Inst., Univ. of Southern California, Los Angeles, CA, and Raytheon STX, Edwards AFB, CA. Briefing notes only

Contract(s)/Grant(s): AF Proj. 2303

Report No.(s): AD-A408615; AFRL-PR-ED-TP-1998-099; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

Efforts are described to combine the  $\text{NF}_4^+$  cation with highly energetic anions, such as  $\text{NO}(2)$ ,  $\text{NO}(3)$ , and  $\text{N}(\text{NO}_2)_2$ . In the case of  $\text{NO}(3)$ , the  $\text{NO}(3)$  anion was fluorinated already at very low temperatures by  $\text{NF}(4)$  to give fluorine nitrate in high yield. In the case of  $\text{NO}(2)$ , the reaction with  $\text{NF}(4)$  yielded an unknown unstable decomposition product in low yield, but the reaction was very difficult to control and consistently exploded. In the case of  $\text{N}(\text{NO}_2)_2$ , again no stable salt was formed, and a thermally unstable decomposition product, probably  $\text{FN}(\text{NO}_2)_2$ , was observed by  $(19)\text{F}$ NMR spectroscopy.

DTIC

*Synthesis (Chemistry); Nitrogen Compounds; Fluorine*

**20030011329** Air Force Research Lab., Space and Missile Propulsion, Edwards AFB, CA USA

**Advanced Chemical Propellants: The High Energy Density Matter Program**

Sheehy, Jeffrey A.; Dec. 13, 1999; 13p; In English; View graphs only. Pres. at JANNAF Propulsion Mtg. Held in Tucson, AZ 14-16 Dec. 1999

Contract(s)/Grant(s): AF Proj. 2303

Report No.(s): AD-A408600; AFRL-PR-ED-TP-1999-0254; No Copyright; Avail: Defense Technical Information Center (DTIC)

Presentation of advanced chemical propellants as an aspect of the high energy density matter program.

DTIC

*Synthesis (Chemistry); High Energy Propellants*

**20030011330** Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

**Hydrocarbon Fuels Optimization**

Mills, J. D.; Jun. 02, 1999; 32p; In English; Viewgraphs only

Contract(s)/Grant(s): AF Proj. 2303

Report No.(s): AD-A408599; AFRL-PR-ED-TP-1999-0125; No Copyright; Avail: Defense Technical Information Center (DTIC)

Hydrocarbon fuels, as a class, are investigated using the minimal set of parameters determinative of oxidizer-optimized specific impulse and common density-specific impulse analogues. In this context specific families of promising candidate fuels can be systematically compare, the performance trade-offs among the relevant chemical and physical properties can be quantified, and the general characteristics of mission-tailored fuels can begin to be elucidated.

DTIC

*Hydrocarbons; Hydrocarbon Fuels; Oxidizers*

**20030011331** Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

**HEDM Research at AFRL: Perspectives, Progress, and Directions**

Sheehy, Jeffrey A.; May 27, 1999; 33p; In English; Viewgraphs only

Contract(s)/Grant(s): AF Proj. 2303

Report No.(s): AD-A408597; AFRL-PR-ED-TP-1999-0118; No Copyright; Avail: Defense Technical Information Center (DTIC)

Presentation of research conducted by the Air Force Research Lab., Edwards AFB, CA, and the development of high energy density materials.

DTIC

*High Energy Propellants; Research and Development*

**20030011334** Air Force Research Lab., Propulsion Directorate West, Edwards AFB, CA USA

**Computational Chemistry and Materials Science for Rocket Propulsion**

Perkins, Leslie S.; Jul. 02, 1999; 16p; In English; Viewgraphs only

Contract(s)/Grant(s): AF Proj. 2303

Report No.(s): AD-A408594; AFRL-PR-ED-TP-1999-0162; No Copyright; Avail: Defense Technical Information Center (DTIC)

Presentation on computational chemistry and materials science for rocket propulsion.

DTIC

*Rocket Propellants; Computational Chemistry*

**20030011467** Los Alamos National Lab., NM USA

**Destruction of Energetic Materials in Supercritical Water *Final Report, 15 Oct. 1987-1 Apr. 1992***

Buelow, S. J.; Allen, D.; Anderson, G. K.; Archuleta, F. L.; Atencio, J. H.; Jun. 25, 2002; 217p; In English; Original contains color images; The original document contains color images. Prepared in cooperation with New Mexico Inst. of Mining and Technology, Chemistry Dept., Socorro, NM

Report No.(s): AD-A408762; AFRL-ML-TY-TR-2002-4522; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

This effort was a survey of the compatibility of a broad series of representative energetic materials (EM) commonly used in propellants, munitions and explosives with a proposed process of controlled decomposition in water near or above the critical temperature (approximately 373 CC), Central issues, in order of consideration, are safety, environmental compatibility of decomposition products, destruction efficiency, extrapolation to compounded formulations of EM, and engineering considerations for scale-up to full-scale operation. The sequence followed in these investigations was: (1) initial safety evaluation and small-scale stability tests on each of 13 individual energetic ingredients commonly used in rocket propellants, munitions, or explosives (all passed this stage); (2) determination of global kinetics and Destruction and Removal Efficiencies (DREs) (destruction was complete - all DREs are limited by sensitivity of detection); (3) identification of products and byproducts of the process to verify environmental compatibility (all tested passed this criterion) ; and (4) detailed reaction kinetics determinations and development of computational models (qualitatively successful application to nitromethane). An important result was the development of safe and practical means to deliver water-insoluble energetic materials (EM) into the supercritical region These methods included: 1) slurried particles, 2) dissolution in an organic solvent or supercritical carbon dioxide, and 3) digestion in aqueous alkali. A pilot-scale continuous pipe reactor suitable for handling slurried, dissolved, or hydrolyzed explosives was built and tested. Results show that supercritical water is a favorable medium for decomposition of waste and off-spec EM. The process appears to be controllable, and the decomposition products are contained until they are consciously released.

DTIC

*Hydrazines; Supercritical Flow; Destruction*

**20030011490** Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

**New Materials Design**

Voth, Gregory; Pachter, Ruth; Gordon, Mark S.; Boatz, Jerry A.; Aug. 31, 1999; 9p; In English; Prepared in collaboration with Univ. of Utah, Salt Lake City, UT, Air Force Research Laboratory, Wright-Patterson AFB, OH, and Iowa State Univ., Ames, IA Contract(s)/Grant(s): Proj-2303

Report No.(s): AD-A408619; AFRL-PR-ED-TP-1999-0174; AFRL-PR-ED-TP-1999-0174; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Progress has been made on several projects under the Challenge Project award. In the area of high energy density materials, calculations are under way on Al atoms embedded in clusters of H<sub>2</sub> molecule. These calculations are very demanding, since very large basis sets and high levels of theory are required to obtain sufficient accuracy for these weakly bound species. Potential energy surfaces are being determined to assess the mobility of an Al atom in H<sub>2</sub> matrices. Similar analyses are underway for B, Be, and Mg atoms. In another HEDM project, a series of large, nitrogen-containing rings, suggested as HEDM targets by Dr. Rob Schmitt at SRI, are being studied. The first of these has been shown to have a very large heat of formation and specific impulse, so it is a very promising species. Calculations on the second compound are in progress. Subsequent calculations will analyze the sensitivity of these compounds to environmental interactions (e.g., hydrolysis, acid/base attack, oxygen). Calculations of the

structures and hydrogen bonding interactions present in 1, 1-diamino-2,2-dinitroethene, a new energetic material with low friction sensitivity, are also underway.

DTIC

*High Energy Propellants; Molecular Dynamics; Nitrogen Compounds; Propulsion*

**20030011539** Army Research Lab., Weapons and Materials Research Directorate, Aberdeen Proving Ground, MD USA

**Applications of Vibrational Spectroscopy in the Study of Explosives**

McNesby, Kevin L.; Pesce-Rodriguez, Rose A.; Dec. 2002; 22p; In English

Report No.(s): AD-A408892; ARL-RP-62; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This article discusses the ways in which vibrational spectroscopy is applied to the study of the class of energetic materials that are commonly called explosives. The article begins with a very brief overview of types and classes of explosives, continues with a few remarks about how a vibrational spectroscopist might approach the study of explosives, discusses some of the most common methods applied to the study of explosives, provides a brief summary of several investigations, and provides a table of vibrational spectroscopic methods and how they have been applied to the study of explosives. A glossary and list of references is also provided. The scientific literature over the last several decades contains thousands of articles dealing with spectroscopy of explosives. Even so, the number of review articles dealing with the applications of vibrational spectroscopy to the study of explosives is limited. Our goal in writing this article is to provide an entry point for those interested in the study of vibrational spectroscopy of explosives, and a reference tool to the spectroscopist currently engaged in explosives research.

DTIC

*Explosives; Vibrational Spectra*

**20030011542** Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

**TTCP Report for May Chan AFRL/PRSP Energetic Ingredients Work for Fiscal Year 2002**

Nov. 06, 2002; 3p; In English

Report No.(s): AD-A408905; AFRL-PR-ED-AB-2002-265; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Nitrocyanamide salts were fully investigated, including the determination of the crystal structures of the monomethylhydrazinium nitrocyanamide, methoxyammonium nitrocyanamide, and the diaminoguanidinium nitrocyanamide. Most of the salts were either impact/friction sensitive or had thermal stability problems. This work is currently being written up into a full manuscript for publication. A new class of energetic ionic liquids based on 1-alkyl-4-amino-1, 2,4-triazolium cations have been synthesized. They have been subsequently paired with energetic anions including the nitrate, perchlorate, dinitramide, and nitrocyanamide. A majority of these materials were recovered in high yield and purity, with melting points below room temperature and high decomposition onsets.

DTIC

*Salts; Crystal Structure; Liquids; Anions; Amines; Alkyl Compounds*

**20030011548** Air Force Research Lab., Propulsion Directorate West, Edwards AFB, CA USA

**Quantum and Classical Monte Carlo and Molecular Dynamics Simulations of the Structures, Photoionization-Induced Fragmentation, and Optical Absorption Spectra of AlArN Clusters**

Boatz, Jerry A.; Sheehy, Jeffrey A.; Hinde, Robert J.; Langhoff, Peter W.; May 27, 1999; 27p; In English

Report No.(s): AD-A408622; AFRL-PR-ED-TP-FY99-0112; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The theory group at AFRL/PRSP is engaged in an ongoing effort to develop, implement, and test the spectral theory of Schrodinger eigenstates for efficient construction of accurate many-body potential energy surfaces for HEDM systems such as atoms embedded in solid hydrogen. Because good experimental data is available for AlAr(sub N) clusters, they make an excellent test bed for the spectral theory and its computational implementation. We have used the spectral theory method to calculate the ground and low-lying excited states of AlAr(sub N) clusters, subsequently employing these in a sequence of quantum and classical Monte Carlo and classical molecular dynamics simulations to predict their structures, photoionization-induced fragmentation pathways, and optical absorption spectra. These simulations address the key issue of the degree of cluster fragmentation encountered following photoionization of the neutral clusters. The measured data refer to ion mass spectrometric signals of AlAr(sub N-M)(+) fragments detected subsequent to one-photon uv excitation followed by visible one-photon ionization of a distribution of non size-selected parent AlAr(sub N) clusters. Thus, the observed spectrum attributed to AlAr(sub N-M) is actually

a superposition of spectra of all parent neutral clusters  $\text{AlAr}(\text{sub } N)$  which produce  $\text{AlAr}(\text{sub } N\text{-M})(+)$  as one of the ionic fragments following the photoionization step.

DTIC

*Absorption Spectra; Fragmentation; Molecular Dynamics; Monte Carlo Method; Photoionization; Quantum Mechanics; Light (Visible Radiation)*

**20030011561** Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

**Theory and Synthesis of New High Energy Density Materials**

Christe, Karl O.; Wilson, William W.; Vij, Ashwani; Sheehy, Jeffrey A.; Boatz, Jerry A.; Oct. 03, 2000; 5p; In English; Prepared in collaboration with Loker Hydrocarbon Research Inst., Univ. of Southern California, Los Angeles, CA

Contract(s)/Grant(s): Proj-2303

Report No.(s): AD-A408649; AFRL-PR-ED-AB-2000-188; AFRL-PR-ED-AB-2000-188; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The aim of this AFOSR program is the synthesis of novel HEDM compounds, exploiting the synergism between theory and synthesis. Theoretical calculations are routinely used to guide the synthesis efforts and to facilitate the identification and characterization of the products.

DTIC

*Nitrogen Compounds; Theories; Synthesis (Chemistry)*

## 29

### SPACE PROCESSING

*Includes space-based development of materials, compounds, and processes for research or commercial application. Also includes the development of materials and compounds in simulated reduced-gravity environments. For legal aspects of space commercialization see 84 Law, Political Science and Space Policy.*

**20030011405** NASA Glenn Research Center, Cleveland, OH USA

**The Awful Truth About Zero-Gravity: Space Acceleration Measurement System; Orbital Acceleration Research Experiment**

STS 107 Shuttle Press Kit: Providing 24/7 Space Science Research; Dec. 16, 2002, pp. 78-79; In English; Also announced as 20030011376; Original contains color illustrations

Report No.(s): NASA/FS-2002-06-073-MSFC; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Earth's gravity holds the Shuttle in orbit, as it does satellites and the Moon. The apparent weightlessness experienced by astronauts and experiments on the Shuttle is a balancing act, the result of free-fall, or continuously falling around Earth. An easy way to visualize what is happening is with a thought experiment that Sir Isaac Newton did in 1686. Newton envisioned a mountain extending above Earth's atmosphere so that friction with the air would be eliminated. He imagined a cannon atop the mountain and aimed parallel to the ground. Firing the cannon propels the cannonball forward. At the same time, Earth's gravity pulls the cannonball down to the surface and eventual impact. Newton visualized using enough powder to just balance gravity so the cannonball would circle the Earth. Like the cannonball, objects orbiting Earth are in continuous free-fall, and it appears that gravity has been eliminated. Yet, that appearance is deceiving. Activities aboard the Shuttle generate a range of accelerations that have effects similar to those of gravity. The crew works and exercises. The main data relay antenna quivers 17 times per second to prevent 'stiction,' where parts stick then release with a jerk. Cooling pumps, air fans, and other systems add vibration. and traces of Earth's atmosphere, even 200 miles up, drag on the Shuttle. While imperceptible to us, these vibrations can have a profound impact on the commercial research and scientific experiments aboard the Shuttle. Measuring these forces is necessary so that researchers and scientists can see what may have affected their experiments when analyzing data. On STS-107 this service is provided by the Space Acceleration Measurement System for Free Flyers (SAMS-FF) and the Orbital Acceleration Research Experiment (OARE). Precision data from these two instruments will help scientists analyze data from their experiments and eliminate outside influences from the phenomena they are studying during the mission.

Author

*Earth Atmosphere; Gravitational Effects; Free Fall; Acceleration Measurement; Space Shuttles; Vibration*



## 31 ENGINEERING (GENERAL)

*Includes general research topics to engineering and applied physics, and particular areas of vacuum technology, industrial engineering, cryogenics, and fire prevention. For specific topics in engineering see categories 32 through 39.*

**20030007785** Swedish Defence Research Establishment, Weapons and Protection Div., Tumba Sweden

### **Method for Smoke Spread Testing of Large Premises**

Walmerdahl, P.; Werling, P.; Nov. 2001; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM.

Report No.(s): PB2003-101028; FOI-R-0046-SE; No Copyright; Avail: National Technical Information Service (NTIS)

A method for performing non-destructive smoke spread tests has been developed, tested and applied to several existing buildings. Burning methanol in different size steel trays cooled by water generates the heat source. Several tray sizes are available to cover fire sources up to nearly 1MW. The smoke is supplied by means of a suitable number of smoke generators that produce a smoke, which can be described as a non-toxic aerosol. The advantage of the method is that it provides a means for performing non-destructive tests in already existing buildings and other installations for the purpose of evaluating the functionality and design of the active fire protection measures such as smoke extraction systems, etc. In the report, the method is described in detail and experimental data from the try-out of the method are also presented in addition to a discussion on applicability and flexibility of the method.

NTIS

*Smoke; Buildings; Performance Tests; Nondestructive Tests; Fire Prevention*

**20030010351** Old Dominion Univ., Center for Advanced Engineering Environments, Hampton, VA USA

### **Simulation of Physical Experiments in Immersive Virtual Environments**

Noor, Ahmed K., Old Dominion Univ., USA; Wasfy, Tamer M., Old Dominion Univ., USA; Engineering Computations; 2001; ISSN 0264-4401; Volume 18, No. 3/4, pp. 515-538; In English; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution under U.S. Government purpose rights under Cooperative Agreement NCC1-01040; Distribution under U.S. Government purpose rights under Cooperative Agreement NCC1-01040

An object-oriented event-driven immersive Virtual environment is described for the creation of virtual labs (VLs) for simulating physical experiments. Discussion focuses on a number of aspects of the VLs, including interface devices, software objects, and various applications. The VLs interface with output devices, including immersive stereoscopic screen(s) and stereo speakers; and a variety of input devices, including body tracking (head and hands), haptic gloves, wand, joystick, mouse, microphone, and keyboard. The VL incorporates the following types of primitive software objects: interface objects, support objects, geometric entities, and finite elements. Each object encapsulates a set of properties, methods, and events that define its behavior, appearance, and functions. A container object allows grouping of several objects. Applications of the VLs include viewing the results of the physical experiment, viewing a computer simulation of the physical experiment, simulation of the experiments procedure, computational steering, and remote control of the physical experiment. In addition, the VL can be used as a risk-free (safe) environment for training. The implementation of virtual structures testing machines, virtual wind tunnels, and a virtual acoustic testing facility is described.

Author

*Computerized Simulation; Mathematical Models; Virtual Reality; Software Engineering; Scientific Visualization*

**20030010359** Old Dominion Univ., Center for Advanced Engineering Environments, Norfolk, VA USA

### **Research on Intelligent Synthesis Environments *Final Report***

Noor, Ahmed K., Old Dominion Univ., USA; Loftin, R. Bowen, Old Dominion Univ., USA; December 2002; 6p; In English Contract(s)/Grant(s): NCC1-01040; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Four research activities related to Intelligent Synthesis Environment (ISE) have been performed under this grant. The four activities are: 1) non-deterministic approaches that incorporate technologies such as intelligent software agents, visual simulations and other ISE technologies; 2) virtual labs that leverage modeling, simulation and information technologies to create an immersive, highly interactive virtual environment tailored to the needs of researchers and learners; 3) advanced learning modules that incorporate advanced instructional, user interface and intelligent agent technologies; and 4) assessment and continuous improvement of engineering team effectiveness in distributed collaborative environments.

Author

*Computerized Simulation; Systems Engineering; Artificial Intelligence; Test Facilities; Programming Environments; Research and Development*



**20030010361** Old Dominion Univ., Dept. of Engineering Management, Norfolk, VA USA

**Virtual Collaborative Environments for System of Systems Engineering and Applications for ISAT**

Dryer, David A., Old Dominion Univ., USA; [2002]; 29p; In English

Contract(s)/Grant(s): NCC1-01040; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper describes an system of systems or metasystems approach and models developed to help prepare engineering organizations for distributed engineering environments. These changes in engineering enterprises include competition in increasingly global environments; new partnering opportunities caused by advances in information and communication technologies, and virtual collaboration issues associated with dispersed teams. To help address challenges and needs in this environment, a framework is proposed that can be customized and adapted for NASA to assist in improved engineering activities conducted in distributed, enhanced engineering environments. The approach is designed to prepare engineers for such distributed collaborative environments by learning and applying e-engineering methods and tools to a real-world engineering development scenario. The approach consists of two phases: an e-engineering basics phase and e-engineering application phase. The e-engineering basics phase addresses skills required for e-engineering. The e-engineering application phase applies these skills in a distributed collaborative environment to system development projects.

Author

*Systems Engineering; Virtual Reality; Distributed Processing; Applications Programs (Computers); Multiprocessing (Computers)*

**20030010362** Old Dominion Univ., Virginia Modeling, Analysis and Simulation Center, Norfolk, VA USA

**Research on Intelligent Synthesis Environment Final Report, 1 Apr. 2001 - 30 Sep. 2002**

Loftin, R. Bowen, Old Dominion Univ., USA; Dryer, David, Old Dominion Univ., USA; Major, Debra, Old Dominion Univ., USA; Fletcher, Tom, Old Dominion Univ., USA; Oct. 28, 2002; 124p; In English; Original contains color illustrations

Contract(s)/Grant(s): NCC1-01040; ODURF Proj. 113282; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The ultimate goal of this research project is to develop a methodology for the assessment and continuous improvement of engineering team effectiveness in distributed collaborative environments. This review provides the theoretical foundation upon which subsequent empirical work will be based. Our review of the team performance literature has identified the following 12 conceptually distinct team interaction processes as characteristic of effective teams. 1) Mission Analysis; 2) Resource Distribution; 3) Leadership; 4) Timing; 5) Intra-team Feedback; 6) Motivational Functions; 7) Team Orientation; 8) Communication; 9) Coordination; 10) Mutual Performance Monitoring; 11) Back-up Behaviors; and 12) Cooperation. In addition, this review summarizes how team task characteristics (i.e., task type, task complexity, motivation, and temporal changes), team characteristics (i.e., team structure and team knowledge), and individual team member characteristics (i.e., dispositions and teamwork knowledge, skills, and abilities) affect team interaction processes, determine the relevance of these processes, and influence team performance. The costs and benefits of distributed team collaboration are also considered. The review concludes with a brief discussion of the nature of collaborative team engineering tasks.

Derived from text

*Artificial Intelligence; Methodology; Systems Engineering; Distributed Processing; Technology Assessment; Research and Development*

**20030011454** Princeton Univ., Dept. of Physics, NJ USA

**Instrumentation for Improvement of Gas Imaging Systems Final Report, 4 Jan. 2001-31 Mar. 2002**

Happer, William; Aug. 08, 2002; 12p; In English

Contract(s)/Grant(s): F49620-01-1-0254

Report No.(s): AD-A408787; AFRL-SR-AR-TR-02-0373; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Funds from the AFOSR:DURIP grant F49620-01-1-0254 have been used to purchase three major pieces of equipment: (1) a nuclear magnetic resonance-spectrometer; system for studies of the basic-physics of hyperpolarized Xe-129 and He-3 gases; (2) a 9.4 T superconducting magnet with a 3 inch room temperature bore; (3) a Verdi diode-pumped Nd:YAG laser to replace the very expensive argon ion laser we have traditionally used for pumping our Ti:sapphire tunable laser. This new equipment has greatly improved the research productivity of our laboratory.

DTIC

*Gases; Imaging Techniques; Nuclear Magnetic Resonance; Instruments*

## COMMUNICATIONS AND RADAR

*Includes radar; radio, wire, and optical communications; land and global communications; communications theory. For related information see also 04 Aircraft Communications and Navigation; and 17 Space Communications, Spacecraft Communications, Command and Tracking; for search and rescue see 03 Air Transportation and Safety, and 16 Space Transportation and Safety.*

**20030007705** Rhode Island Univ., Transportation Center, Kingston, RI USA

**Interactions of Transportation and Telecommunications Behaviors**

Dholakia, N.; Mundorf, N.; Dholakia, R. R.; Xiao, J. J.; May 2002; 68p; In English

Report No.(s): PB2003-101674; URITC-536111; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This project was designed as a social science complement to the engineering studies supported by the University of Rhode Island (URI) Transportation Center (URITC). The project developed a behavioral knowledge base about the actual and intended transport and telecommunications behaviors of transportation users, with a particular focus on southern Rhode Island. Background studies, drawing from literature on telecommuting and travel behavior, led to the development of a generalized framework to understand the transport-telecom interactions. In particular, we developed working papers dealing with transport aspects of e-retailing and distance education. In the empirical part of this project, two major field studies were completed. The first of these was a survey of URI students, probing their car travel, carpool, bus use, and Internet use behaviors. The students were surveyed first by telephone, selected randomly from a list obtained from the Register's office. A total of 220 students responded to the telephone survey. Characteristics of the telephone survey respondents are shown in Appendix B. This was supplemented by an in-class survey of 107 students conveniently selected from the courses taught by the research faculty. This supplementary questionnaire probed the students more deeply regarding their motivations for transportation and technology use issues. The second major field study was a mail survey of southern Rhode Island residents. In this survey, we not only investigated actual travel and transport behaviors but also measured attitudes towards the environment and alternative transport and telecommuting solutions. At the time of writing this report, about 850 individuals had responded to our mail questionnaire. Characteristics of the resident sample are described in Appendix B. The results have laid the groundwork for our second year project where we plan to study the impact of specific interventions on transportation and telecommuting attitudes and intentions.

NTIS

*Transportation; Telecommunication; Education; Sociology*

**20030007914** NASA Langley Research Center, Hampton, VA USA

**Ultrawideband Electromagnetic Interference to Aircraft Radios**

Ely, Jay J., NASA Langley Research Center, USA; Fuller, Gerald L., Eagles Wings, Inc., USA; Shaver, Timothy W., United Air Lines, Inc., USA; [2002]; 12p; In English; 21st Digital Avionics Systems Conference, 27-31 Oct. 2002, Irvine, CA, USA; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

A very recent FCC Final Rule now permits marketing and operation of new products that incorporate Ultrawideband (UWB) technology into handheld devices. Wireless product developers are working to rapidly bring this versatile, powerful and expectedly inexpensive technology into numerous consumer wireless devices. Past studies addressing the potential for passenger-carried portable electronic devices (PEDs) to interfere with aircraft electronic systems suggest that UWB transmitters may pose a significant threat to aircraft communication and navigation radio receivers. NASA, United Airlines and Eagles Wings Incorporated have performed preliminary testing that clearly shows the potential for handheld UWB transmitters to cause cockpit failure indications for the air traffic control radio beacon system (ATCRBS), blanking of aircraft on the traffic alert and collision avoidance system (TCAS) displays, and cause erratic motion and failure of instrument landing system (ILS) localizer and glideslope pointers on the pilot horizontal situation and attitude director displays. This paper provides details of the preliminary testing and recommends further assessment of aircraft systems for susceptibility to UWB electromagnetic interference.

Author

*Wideband Communication; Aircraft Communication; Electromagnetic Interference; Air Traffic Control; Radio Equipment; Nondestructive Tests; Signal Processing*

**20030011545** Coast Guard, Washington, DC USA

**Cutter Connectivity Bandwidth Study Final Report**

Oct. 2002; 17p; In English; Original contains color images

Contract(s)/Grant(s): AF Proj. 9270

Report No.(s): AD-A408927; USCG-D-03-02; No Copyright; Avail: Defense Technical Information Center (DTIC)

The goal of this study was to determine how much bandwidth is required for cutters to meet emerging data transfer requirements. The Cutter Connectivity Business Solutions Team with guidance from the Commandant's 5 Innovation Council sponsored this study. Today, many Coast Guard administrative and business functions are being conducted via electronic means. Although our larger cutters can establish part-time connectivity using commercial satellite communications (SATCOM) while underway, there are numerous complaints regarding poor application performance. Additionally, smaller cutters do not have any standard means of underway connectivity. The R&D study shows the most important factor affecting web performance and enterprise applications onboard cutters was latency. Latency describes the time it takes the signal to reach the satellite and come back down through space. The latency due to use of higher orbit satellites is causing poor application performance and inefficient use of expensive SATCOM links. To improve performance, the CC must, (1) reduce latency by using alternate communications links such as low-earth orbit satellites, (2) tailor applications to the SATCOM link and/or (3) optimize protocols used for data communication to minimize time required by present applications to establish communications between the user and the host systems.

DTIC

*Communication Networks; Satellite Communication*

**20030011557** Du Pont de Nemours (E. I.) and Co., Superconductivity Experiment Station, Wilmington, DE USA

**Novel Ferroelectric Materials for Satellite Communications Final Report, 7 May 1998-14 Jun. 2001**

Face, Dean; McCambridge, James; Nov. 11, 2002; 149p; In English

Contract(s)/Grant(s): DABT63-98-C0-0046

Report No.(s): AD-A408642; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This report summarizes work performed by DuPont and the University of Colorado. The work was divided into seven key task areas: (1) Large Area Sputtered Film Manufacturing for Cryogenic Temperature, (2) Large Area Sputtered Film Manufacturing for Ambient Temperature, (3) Multilayer Film Development and Manufacturing, (4) Exploratory Laser Ablation Processing (University of Colorado), (5) Materials Discovery Research, (6) Rapid Test Method Development, and (7) Demonstration Device Design and Test. A wide range of ferroelectric materials and related compounds were explored for use in tunable microwave devices: the best figures of merit of thin films for cryogenic operation were in the range 15-20; the best results for room temperature were lower, generally less than 5. Tunable filters and devices were designed which frequency tunabilities in the range of 5-10% with low Q.

DTIC

*Cryogenic Temperature; Ferroelectric Materials; Manufacturing; Satellite Communication*

### 33

## ELECTRONICS AND ELECTRICAL ENGINEERING

*Includes development, performance, and maintainability of electrical/electronic devices and components; related test equipment and microelectronics and integrated circuitry. For related information see also 60 Computer Operations and Hardware; and 76 Solid-State Physics. For communications equipment and devices see 32 Communications and Radar.*

**20030007922** AEther Wire and Location, Inc., Nicasio, CA USA

**Distributed Position Location Final Report, Jul. 1998-Jul 2001**

Fleming, Robert; Kushner, Cherie; Nandiwada, Uday; Coli, Vincent; Sep. 2002; 34p; In English; Original contains color images

Contract(s)/Grant(s): F30602-98-C-0184; Proj-G333

Report No.(s): AD-A408193; AFRL-IF-RS-TR-2002-248; No Copyright; Avail: Defense Technical Information Center (DTIC)

AEther Wire had, prior to this project, developed the base technology to radiate and receive ultra-wideband signals. During this project, AEther Wire advanced this base technology to demonstrate a network-based localization system with eight nodes based on our fourth generation Localizer. Information regarding the embedded software, hardware development, antenna design, and integrated circuit design are presented in this report. Specific tasks included: (1) Development of networking, control, and signal processing software for AEther Wire's fourth generation Localizer. (2) Research and development of improved transmit antennas and drivers, receive antennas, and amplifiers for ultra-wideband signals. (3) Revision of custom Driver and Receiver chips to implement circuit enhancements and accommodate plastic packaging. (4) Exploration of the design of a single chip solution using System-on-a-Chip (SoC) methodology.

DTIC

*Position (Location); Signal Processing; Computer Programming; Software Engineering; Electronic Equipment*

**20030009552** Old Dominion Univ., Research Foundation, Norfolk, VA USA

**Modeling of InGaAsSb-Based Avalanche Photodetectors for 2-Micron Wavelengths Final Report**

Joshi, Ravindra P., Old Dominion Univ., USA; December 2002; 62p; In English; Original contains color illustrations

Contract(s)/Grant(s): NAG1-02072; ODURF Proj. 122231; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The main focus of this research is to study and evaluate the potential of InGaAsSb-AlGaAsSb based 2 micron avalanche photo-detectors. The photodetector contains a separate absorption and multiplication region (SAM) structure. The analysis has mainly been done to understand the electrical response characteristics of the devices existing at NASA, and to evaluate alternate structures proposed. Calculating the current flow for the existing detector structure, on the basis of its energy band diagram, is important. This analysis also helps to find shortcomings in the existing detector structure. It is shown that, unfortunately, the existing structure cannot lead to strong multiplication or voltage dependent gain. Two alternate structures are suggested, that could overcome the inherent flaws, and help achieve improved performance. These devices are obtained through modifications of the original structure, which include varying the doping levels, and changing the thicknesses of detector sub-regions. The results of our study are presented and discussed.

Author

*Models; Avalanches; Photometers; Indium Gallium Arsenides*

**20030010295** NASA Glenn Research Center, Cleveland, OH USA

**Intersymbol Interference Investigations Using a 3D Time-Dependent Traveling Wave Tube Model**

Kory, Carol L., Analex Corp., USA; Andro, Monty, NASA Glenn Research Center, USA; [2002]; 11p; In English; 20th AIAA International Communication Satellite Systems Conference and Exhibit, 12-15 May 2002, Montreal, Quebec, Canada; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 2002-1896; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

For the first time, a time-dependent, physics-based computational model has been used to provide a direct description of the effects of the traveling wave tube amplifier (TWTA) on modulated digital signals. The TWT model comprehensively takes into account the effects of frequency dependent AM/AM and AM/PM conversion; gain and phase ripple; drive-induced oscillations; harmonic generation; intermodulation products; and backward waves. Thus, signal integrity can be investigated in the presence of these sources of potential distortion as a function of the physical geometry and operating characteristics of the high power amplifier and the operational digital signal. This method promises superior predictive fidelity compared to methods using TWT models based on swept- amplitude and/or swept-frequency data. First, the TWT model using the three dimensional (3D) electromagnetic code MAFIA is presented. Then, this comprehensive model is used to investigate approximations made in conventional TWT black-box models used in communication system level simulations. To quantitatively demonstrate the effects these approximations have on digital signal performance predictions, including intersymbol interference (ISI), the MAFIA results are compared to the system level analysis tool, Signal Processing Workstation (SPW), using high order modulation schemes including 16 and 64-QAM.

Author

*Intersymbolic Interference; Mathematical Models; Time Dependence; Traveling Wave Tubes; Three Dimensional Models*

**20030010497** Lehigh Univ., Materials Research Center, Bethlehem, PA USA

**A Focused-Ion Beam (FIB) Nano-Fabrication and Characterization Facility Final Report, 1 May 2001-30 Apr. 2002**

Harmer, M. P.; Nov. 22, 2002; 7p; In English

Contract(s)/Grant(s): N00014-01-1-0730

Report No.(s): AD-A408750; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This has been a most successful project. The FIB has been purchased, installed and is now the most productive instrument in the Microscopy Center at Lehigh. Substantial research has been accomplished by the group of the principal investigator, but much research has been done by many other groups as well. Much of the work has involved the preparation of samples for examination in the transmission electron microscope (TEM) and scanning electron microscope (SEM), but - as anticipated in the proposal - several experiments have already used the FIB for novel methods of nanofabrication of devices.

DTIC

*Electron Microscopes; Scanners; Fabrication; Ion Beams; Beam Steering; Piezoelectric Actuators*

**20030010516** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

**Multi-Band GaAs/AlGaAs Quantum Well Infrared Photodetector (QWIP) Focal Plane Arrays**

Bandara, S. V.; Gunapala, S. D.; Liu, J. K.; Rafol, S. B.; Shott, C. A.; Jul. 29, 2002; 7p; In English; Original contains color images;



See Also ADM201460. Papers from Unclassified Proceedings from the 11th Annual AIAA/MDA Technology Conference held 29 July - 2 August 2002 in Monterey, CA., The original document contains color images

Report No.(s): AD-A408864; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The GaAs/AlGaAs based Quantum Well Infrared Photodetectors (QWIPs) afford greater flexibility than the usual extrinsically doped semiconductor IR detectors because the wavelength of the peak response and cutoff can be continuously tailored over any wavelength between 6-20 micrometers. The spectral band width of these detectors can be tuned from narrow ( $\Delta\lambda/\lambda$  approx. 10 %) to wide ( $\Delta\lambda/\lambda$  approx. 50 %) allowing various applications. Also, QWIP offers multi-color infrared cameras which is capable of simultaneously acquiring images in different infrared bands. Each pixel of such array consists of vertically stacked, independently readable, QWIP detectors sensitive in different narrow infrared bands. In this article, we discuss the development and results of the 640 x 512 dual-band and four-band QWIP FPAs.

DTIC

*Quantum Theory; Infrared Radiation; Aluminum Gallium Arsenides; Quantum Wells; Infrared Detectors; Photometers; Focal Plane Devices*

**20030011262** Georgia Inst. of Tech., School of Electrical Engineering, Atlanta, GA USA

**Multispectral Detector Array Technology Final Report, 12 Mar. 1998-14 Dec. 1999**

Jokerst, Nan M.; Dec. 1999; 21p; In English

Contract(s)/Grant(s): F30602-98-1-0115; AF Proj. 2305

Report No.(s): AD-A408608; AFRL-SN-HS-TR-2002-041; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A sensor is a device used to sense or measure physical phenomena. Thus, sensors may detect electrical, mechanical, optical, chemical, tactile, or acoustic signatures of an object or scene. Objects that may be difficult to discriminate using a single sensor are often differentiated with a multiple sensor system that exploits several signature phenomena. The application of multiple sensors (and the fusion of their data) offers numerous potential performance benefits over traditional single sensor approaches. In our application, which is infrared target discrimination, employing multiple sensors, which respond to different signatures, increases the probability that a target signature will be found against a given set of weather, clutter or background noise sources. A multiple sensor system, in other words, diminishes ambiguity and uncertainty in the measured information by reducing the set of hypotheses about the target or event. Multiple sensors may also be used to reduce the vulnerability to false conclusions drawn from data of a single sensor. For instance, missiles may carry multiple sensors to better guarantee a hit or a radar can use multiple sensors to counter-jam incoming missiles.

DTIC

*Infrared Radiation; Focal Plane Devices; Multispectral Linear Arrays*

**20030011530** Air Force Research Lab., Sensors Directorate, Hanscom AFB, MA USA

**Conformal Antenna Research in the US**

Mailloux, Robert J.; Oct. 2000; 4p; In English

Report No.(s): AD-A408869; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Within the USA, interest in conformal and low profile antennas is in response to space and airborne requirements, and also to the volume constraints of shipborne radar. Elements and arrays on generalized surfaces have also been analyzed using the finite difference time domain (FDTD) and finite element (FEM) methods. Analytical results for antennas on electrically larger bodies have been obtained using a combination of the Method of Moments (MOM) plus quasi-optical techniques. Recent work extends the utility of the hybrid methods using new Green's functions developed from the Uniform Geometrical Theory of Diffraction (UTD) to elevate the mutual coupling between elements on a uniformly coated, perfectly conducting, but otherwise arbitrarily shaped convex surface. In addition to advances in analytical treatments, a number of small arrays have been built conformal to cylinders and other metallic structures. Fully electronically scanned arrays have been developed for airborne satcom at SHF and EHF frequencies. Arrays with dimensions large compared to the local radius of curvature will also be discussed, including an ultra wide band UHF radar array

DTIC

*Radar Antennas; Antenna Arrays*

**20030011532** Air Force Research Lab., Sensors Directorate, Hanscom AFB, MA USA

**Wideband Subarray Systems: Evolution of a Research Area**

Mailloux, Robert J.; Nov. 12, 1998; 4p; In English

Report No.(s): AD-A408872; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche



This paper discusses developments in the technology of transform-fed wideband scanning arrays. These antennas were introduced over 40 years ago, and proposed for a large number of scanning applications, but because of poor efficiency and high cost, have not found application in fielded systems. Recent technological innovations including MEMS phase shifters and digital beamforming have re-focused attention on these systems, which for many applications remain the most viable array architecture for large wide band arrays.

DTIC

*Broadband; Antennas*

**20030011533** Air Force Research Lab., Sensors Directorate, Hanscom AFB, MA USA

**Phased Array Technology and Allerton**

Mailloux, Robert J.; Jan. 2002; 5p; In English

Report No.(s): AD-A408874; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

For the past fifty years the Antenna Applications Symposium at Allerton has provided a podium for engineers to discuss all aspects of antenna engineering. This paper addresses the subject of phased array development, and catalogs some of the papers presented at Allerton that have contributed to this development.

DTIC

*Phased Arrays; Antenna Arrays; Conferences; Papers*

**20030011537** Stanford Univ., Edward L. Ginzton Lab. of Physics, Stanford, CA USA

**Development of High Average Power Nonlinear Frequency Conversion Devices *Final Report, 15 May 1999-30 Nov. 2001***

Fejer, Martin M.; Route, Robert K.; Aug. 2002; 18p; In English

Contract(s)/Grant(s): F49620-99-1-0270

Report No.(s): AD-A408888; SPO-20861; GL-5763; AFRL-SR-AR-TR-02-0364; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This program developed microstructured nonlinear optical materials and quasi-phasematched devices based on those materials. The two material systems investigated, periodically-poled ferroelectrics, especially lithium niobate (PPLN), and orientation-patterned GaAs (OP-GaAs) enable nonlinear interactions impossible in conventional nonlinear media. This work included the generation of the shortest blue light pulse then reported (5,4 fs), demonstration of orientation patterned GaAs (OP-GaAs), a mid-IR analog for PPLN operating to wavelengths greater than 12 micrometers with 10 times larger nonlinear figure of merit than PPLN, vapor transport synthesis of stoichiometric lithium tantalate (with no measurable room-temperature photorefractive damage), chirped-pulse parametric amplifiers generating millijoule ultrafast pulses in a simple single-pass configuration, guided-wave frequency mixers with efficiencies of 3000%/W, enabling demonstration of extreme phenomena such as 99% pump depleted SHG (with only 900 mW pump power), and optical parametric generators with 300 pJ thresholds. Significant projects seeded by the work in this program have been spun off as industry-supported projects. In particular optical signal processing devices for communications based on the waveguide mixers, and IRCM applications of the OP-GaAs.

DTIC

*Nonlinear Optics; Ferroelectric Materials; Frequency Converters; Vapors; Chirp*

**20030011538** Texas Univ., Inst. for Advanced Technology, Austin, TX USA

**Analytical Series Expressions for the Self- and Mutual Inductances of Two-Dimensional Coils in the Form of Partial Sectors**

Thiagarajan, V.; Nov. 2002; 16p; In English; Original contains color images

Contract(s)/Grant(s): DAAD17-01-D-0001

Report No.(s): AD-A408890; IAT.R 0288; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Pulsed power generators of the drum type utilize radial components of magnetic fields created by field coils located on a rotor to induce voltage on stator coils located at larger radii. Conventionally, two-dimensional field analyses are used, and further, the field is expressed as a harmonic series and the fundamental part of the radial field is used for initial designs. Analytical series expressions for two-dimensional potentials and fields are utilized in this paper to derive analytical series expressions for the self-inductances and mutual inductances between the rotor and stator coils in the shape of partial sectors. The magnitudes of higher order terms are compared with that of the fundamental component. The effects of parameters such as the aspect ratios of conductor sections on the inductances and coupling constants are evaluated.

DTIC

*Inductance; Electric Coils*

**20030011541** Lawrence Livermore National Lab., Livermore, CA USA

**A Nonlinear Fuel Optimal Reaction Jet Control Law**

Breitfeller, Eric F.; Ng, Lawrence C.; Jul. 29, 2002; 10p; In English; Original contains color images; See Also ADM201460. Papers from Unclassified Proceedings from the 11th Annual AIAA/MDA Technology Conference held 29 July - 2 August 2002 in Monterey, CA., The original document contains color images

Report No.(s): AD-A408899; PAPER 6-5; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

We derive a nonlinear fuel optimal attitude control system (ACS) that drives the final state to the desired state according to a cost function that weights the final state angular error relative to the angular rate error. Control is achieved by allowing the pulse-width-modulated (PWM) commands to begin and end anywhere within a control cycle, achieving a pulse width pulse time (PWPT) control. We show through a MATLAB- Simulink model that this steady-state condition may be accomplished, in the absence of sensor noise or model uncertainties, with the theoretical minimum number of actuator cycles. The ability to analytically achieve near-zero drift rates is particularly important in applications such as station keeping and sensor imaging. Consideration is also given to the fact that, for relatively small sensor and model errors, the controller requires significantly fewer actuator cycles to reach the final state error than a traditional proportional integral-derivative (PID) controller. The optimal PWPT attitude controller may be applicable for a high performance kinetic energy kill vehicle.

DTIC

*Attitude Control; Nonlinearity; Jet Engine Fuels*

**34**

**FLUID MECHANICS AND THERMODYNAMICS**

*Includes fluid dynamics and kinematics and all forms of heat transfer; boundary layer flow; hydrodynamics; hydraulics; fluidics; mass transfer and ablation cooling. For related information see also 02 Aerodynamics.*

**20030007685** Spectral Sciences, Inc., Burlington, MA USA

**Chemical and Flowfield Modeling for Enhanced Analysis of Contamination Experiments**

Braunstein, Matthew, Spectral Sciences, Inc., USA; Oct. 30, 2001; 11p; In English; 40th Aerospace Sciences Meeting, 14-17 Jan. 2002, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Original contains color illustrations Contract(s)/Grant(s): NAS8-00201

Report No.(s): AIAA Paper 2002-8039; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution under U.S. Government purpose rights; Distribution under U.S. Government purpose rights

This paper describes the application of a new Direct Simulation Monte Carlo (DSMC) code, the Molecular Beam Simulator (MBS), which is designed to analyze laboratory scale molecular beam-surface (and crossed-beam) experiments. The MBS is primarily intended to model experiments associated with spacecraft contamination effects, but it can also be used to simulate a variety of surface chemistry and reactive flow measurements. The MBS code is fully three-dimensional, includes a wide-range of chemical processes, and can model one or multiple pulsed (non-steady) sources. As an example application of the MBS code, a fast, pulsed, oxygen atom-surface experiment which examines the chemistry behind erosion of graphite by oxygen atoms is analyzed. Unsteady DSMC simulations show that experimental observations of excited molecular states after the pulse has hit the surface are consistent with two distinct chemical mechanisms: a direct one where the excited molecules are formed on the surface, and a two-step mechanism where ground state molecules formed on the surface are collisionally excited after they leave the surface by trailing oxygen atoms in the pulse. Further DSMC calculations suggest experiments which can distinguish between these mechanisms.

Author

*Monte Carlo Method; Chemical Reactions; Flow Distribution; Computerized Simulation; Contamination; Molecular Beams*

**20030007708** NASA Langley Research Center, Hampton, VA USA

**Experimental Feedback Control of Flow Induced Cavity Tones**

Cabell, Randolph H., NASA Langley Research Center, USA; Kegerise, Michael A., NASA Langley Research Center, USA; Cox, David E., NASA Langley Research Center, USA; Gibbs, Gary P., NASA Langley Research Center, USA; [2002]; 10p; In English; 8th AIAA/CEAS Aeroacoustics Conference, 16-18 Jun. 2002, Breckenridge, CO, USA; Sponsored by American Society of Mechanical Engineers, USA

Report No.(s): AIAA Paper 2002-2497; Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; Distribution under U.S. Government purpose rights; Distribution under U.S. Government purpose rights

An experimental study of the application of discrete-time, linear quadratic control design methods to the cavity tone problem is described. State space models of the dynamics from a synthetic jet actuator at the leading edge of the cavity to two pressure sensors in the cavity were computed from experimental data. Variations in model order, control order, control bandwidth, and properties of a Kalman state estimator were studied. Feedback control reduced the levels of multiple cavity tones at Mach 0.275, 0.35, and 0.45. Closed loop performance was often limited by excitation of sidebands of cavity tones, and creation of new tones in the spectrum. State space models were useful for explaining some of these limitations, but were not able to account for non-linear dynamics, such as interactions between tones at different frequencies.

Author

*Feedback Control; Cavities; Aeroacoustics; Actuators; Pressure Sensors; Leading Edges*

**20030007716** Sandia National Labs., Albuquerque, NM USA

**Development of the Large Eddy Simulation Approach for Modeling Turbulent Flow *Final Report***

Schmidt, R. C.; Smith, T. M.; DesJardin, P. E.; Voth, T. E.; Christon, M. A.; Mar. 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM

Report No.(s): DE2002-800791; SAND2002-0807; No Copyright; Avail: National Technical Information Service (NTIS)

This report describes research and development of the large eddy simulation (LES) turbulence modeling approach conducted as part of Sandia's laboratory directed research and development (LDRD) program. The emphasis of the work described here has been toward developing the capability to perform accurate and computationally affordable LES calculations of engineering problems using unstructured-grid codes, in wall-bounded geometries and for problems with coupled physics. Specific contributions documented here include (1) the implementation and testing of LES models in Sandia codes, including tests of a new conserved scalar-laminar flamelet SGS combustion model that does not assume statistical independence between the mixture fraction and the scalar dissipation rate, (2) the development and testing of statistical analysis and visualization utility software developed for Exodus II unstructured grid LES, and (3) the development and testing of a novel new LES near-wall subgrid model based on the one-dimensional Turbulence (ODT) model.

NTIS

*Computerized Simulation; Turbulence Models; Mathematical Models; Large Eddy Simulation; Combustion Physics*

**20030007730** Swedish Defence Research Establishment, Aeronautics Div., Stockholm Sweden

**Optimal Control in Wall Bounded Flows**

Hogberg, M.; Chevalier, M.; Berggren, M.; Henningson, D. S.; Oct. 2001; 46p; In English

Report No.(s): PB2003-101015; FOI-R-0182-SE; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Optimal control of transition in channel flow and boundary layer flow is attempted. First the optimization problem is stated and the corresponding adjoint equations used to compute the gradient of the objective function are derived for both the channel flow and boundary layer flow problems. Implementation and numerical issues are discussed. The governing equations are the incompressible Navier-Stokes equations with appropriate boundary conditions for the two cases. The boundary condition on the wall normal velocity at the walls of the channel, or at the single wall in the boundary layer case, is used as control and is determined in the iterative optimization procedure. The objective function used for the optimization problem contains the perturbation energy and a regularization term containing the control. The optimization problems is formulated using the primitive variables-velocity and pressure-and is then rewritten in a formulation containing only the wall normal velocity and the wall normal vorticity.

NTIS

*Channel Flow; Boundary Layer Flow; Optimization; Incompressible Flow; Boundary Conditions*

**20030007790** Virginia Univ., Aerospace Research Lab., Charlottesville, VA USA

**Velocity Measurement in a Dual-Mode Supersonic Combustor using Particle Image Velocimetry**

Goyne, C. P., Virginia Univ., USA; McDaniel, J. C., Virginia Univ., USA; Krauss, R. H., Virginia Univ., USA; Day, S. W., Virginia Univ., USA; [2001]; 17p; In English; AIAA/NAL-NASDA-ISAS 10th International Space Planes and Hypersonic Systems and Technologies Conference, 24-27 Apr. 2001, Kyoto, Japan; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Original contains color illustrations

Contract(s)/Grant(s): NAG1-2085; NAG1-2131

Report No.(s): AIAA Paper 2001-1761; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution under U.S. Government purpose rights under grant NAG1-2131; Distribution under U.S. Government purpose rights under grant NAG1-2131

Temporally and spatially-resolved, two-component measurements of velocity in a supersonic hydrogen-air combustor are reported. The combustor had a single unswept ramp fuel injector and operated with an inlet Mach number of 2 and a flow total

temperature approaching 1200 K. The experiment simulated the mixing and combustion processes of a dual-mode scramjet operating at a flight Mach number near 5. The velocity measurements were obtained by seeding the fuel with alumina particles and performing Particle Image Velocimetry on the mixing and combustion wake of the ramp injector. To assess the effects of combustion on the fuel air-mixing process, the distribution of time-averaged velocity and relative turbulence intensity was determined for the cases of fuel-air mixing and fuel-air reacting. Relative to the mixing case, the near field core velocity of the reacting fuel jet had a slower streamwise decay. In the far field, downstream of 4 to 6 ramp heights from the ramp base, the heat release of combustion resulted in decreased flow velocity and increased turbulence levels. The reacting measurements were also compared with a computational fluid dynamics solution of the flow field. Numerically predicted velocity magnitudes were higher than that measured and the jet penetration was lower.

Author

*Combustion Chambers; Particle Image Velocimetry; Hybrid Propulsion; Supersonic Wind Tunnels; Computational Fluid Dynamics; Supersonic Combustion Ramjet Engines; Flow Velocity*

**20030007795** NASA Langley Research Center, Hampton, VA USA

**The Langley Stability and Transition Analysis Code (LASTRAC) : LST, Linear and Nonlinear PSE for 2-D, Axisymmetric, and Infinite Swept Wing Boundary Layers**

Chang, Chau-Lyan, NASA Langley Research Center, USA; [2003]; 20p; In English; 41st AIAA Aerospace Sciences Meeting and Exhibit, 6-9 Jan. 2003, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 2003-0974; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

During the past two decades, our understanding of laminar-turbulent transition flow physics has advanced significantly owing to, in a large part, the NASA program support such as the National Aerospace Plane (NASP), High-speed Civil Transport (HSCT), and Advanced Subsonic Technology (AST). Experimental, theoretical, as well as computational efforts on various issues such as receptivity and linear and nonlinear evolution of instability waves take part in broadening our knowledge base for this intricate flow phenomenon. Despite all these advances, transition prediction remains a nontrivial task for engineers due to the lack of a widely available, robust, and efficient prediction tool. The design and development of the LASTRAC code is aimed at providing one such engineering tool that is easy to use and yet capable of dealing with a broad range of transition related issues. LASTRAC was written from scratch based on the state-of-the-art numerical methods for stability analysis and modern software technologies. At low fidelity, it allows users to perform linear stability analysis and N-factor transition correlation for a broad range of flow regimes and configurations by using either the linear stability theory (LST) or linear parabolized stability equations (LPSE) method. At high fidelity, users may use nonlinear PSE to track finite-amplitude disturbances until the skin friction rise. Coupled with the built-in receptivity model that is currently under development, the nonlinear PSE method offers a synergistic approach to predict transition onset for a given disturbance environment based on first principles. This paper describes the governing equations, numerical methods, code development, and case studies for the current release of LASTRAC. Practical applications of LASTRAC are demonstrated for linear stability calculations, N-factor transition correlation, non-linear breakdown simulations, and controls of stationary crossflow instability in supersonic swept wing boundary layers.

Author

*Laminar Flow; Boundary Layer Transition; Computer Programs; Numerical Analysis; Software Engineering; Transition Flow*

**20030007847** NASA Langley Research Center, Hampton, VA USA

**Wake Vortex Prediction Models for Decay and Transport Within Stratified Environments**

Switzer, George F., Research Triangle Inst., USA; Proctor, Fred H., NASA Langley Research Center, USA; [2002]; 7p; In English; 40th Aerospace Sciences Meeting and Exhibit, 14-17 Jan. 2002, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Original contains color illustrations

Contract(s)/Grant(s): NAS1-99074

Report No.(s): AIAA Paper 2002-0945; Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; Distribution under U.S. Government purpose rights under contract number NAS1-99074; Distribution under U.S. Government purpose rights under contract number NAS1-99074

This paper proposes two simple models to predict vortex transport and decay. The models are determined empirically from results of three-dimensional large eddy simulations, and are applicable to wake vortices out of ground effect and not subjected to environmental winds. The results, from the large eddy simulations assume a range of ambient turbulence and stratification levels. The models and the results from the large eddy simulations support the hypothesis that the decay of the vortex hazard is decoupled from its change in descent rate.

Author

*Vortices; Wakes; Predictions; Three Dimensional Models; Large Eddy Simulation; Mathematical Models; Stratification*



**20030007848** NASA Langley Research Center, Hampton, VA USA

**Summary of Data from the First AIAA CFD Drag Prediction Workshop**

Levy, David W., Cessna Aircraft Co., USA; Zickuhr, Tom, Cessna Aircraft Co., USA; Vassberg, John, Boeing Co., USA; Agrawal, Shreekanth, Boeing Co., USA; Wahls, Richard A., NASA Langley Research Center, USA; Pirzadeh, Shahyar, NASA Langley Research Center, USA; Hemsch, Michael J., NASA Langley Research Center, USA; [2002]; 16p; In English; 40th AIAA Aerospace Sciences Meeting, 14-17 Jan. 2002, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): NAS1-19480

Report No.(s): AIAA Paper 2002-0841; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution under U.S. Government purpose rights under contract number NAS1-19480; Distribution under U.S. Government purpose rights under contract number NAS1-19480

The results from the first AIAA CFD Drag Prediction Workshop are summarized. The workshop was designed specifically to assess the state-of-the-art of computational fluid dynamics methods for force and moment prediction. An impartial forum was provided to evaluate the effectiveness of existing computer codes and modeling techniques, and to identify areas needing additional research and development. The subject of the study was the DLR-F4 wing-body configuration, which is representative of transport aircraft designed for transonic flight. Specific test cases were required so that valid comparisons could be made. Optional test cases included constant- $C_{sub L}$  drag-rise predictions typically used in airplane design by industry. Results are compared to experimental data from three wind tunnel tests. A total of 18 international participants using 14 different codes submitted data to the workshop. No particular grid type or turbulence model was more accurate, when compared to each other, or to wind tunnel data. Most of the results overpredicted  $C_{sub Lo}$  and  $C_{sub Do}$ , but induced drag ( $dC_{sub D}/dC_{sub L}(exp 2)$ ) agreed fairly well. Drag rise at high Mach number was underpredicted, however, especially at high  $C_{sub L}$ . On average, the drag data were fairly accurate, but the scatter was greater than desired. The results show that well-validated Reynolds-Averaged Navier-Stokes CFD methods are sufficiently accurate to make design decisions based on predicted drag.

Author

*Computational Fluid Dynamics; Drag; Predictions; Body-Wing Configurations; Wind Tunnel Tests*

**20030007884** NASA Ames Research Center, Moffett Field, CA USA

**Automatic Generation of CFD-Ready Surface Triangulations from CAD Geometry**

Aftosmis, M. J., NASA Ames Research Center, USA; Delanaye, M., NASA Ames Research Center, USA; Haimes, R., Massachusetts Inst. of Tech., USA; Dec. 23, 1998; 15p; In English; 37th AIAA Aerospace Sciences Meeting, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): NAG3-2019; RTOP 522-31-12

Report No.(s): AIAA Paper 99-0776; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution under U.S. Government purpose rights under grant number NAG3-2019; Distribution under U.S. Government purpose rights under grant number NAG3-2019

This paper presents an approach for the generation of closed manifold surface triangulations from CAD geometry. CAD parts and assemblies are used in their native format, without translation, and a part's native geometry engine is accessed through a modeler-independent application programming interface (API). In seeking a robust and fully automated procedure, the algorithm is based on a new physical space manifold triangulation technique which was developed to avoid robustness issues associated with poorly conditioned mappings. In addition, this approach avoids the usual ambiguities associated with floating-point predicate evaluation on constructed coordinate geometry in a mapped space. The technique is incremental, so that each new site improves the triangulation by some well defined quality measure. Sites are inserted using a variety of priority queues to ensure that new insertions will address the worst triangles first. As a result of this strategy, the algorithm will return its 'best' mesh for a given (prespecified) number of sites. Alternatively, the algorithm may be allowed to terminate naturally after achieving a prespecified measure of mesh quality. The resulting triangulations are 'CFD-ready' in that: (1) Edges match the underlying part model to within a specified tolerance. (2) Triangles on disjoint surfaces in close proximity have matching length-scales. (3) The algorithm produces a triangulation such that no angle is less than a given angle bound,  $\alpha$ , or greater than  $\pi - 2\alpha$ . This result also sets bounds on the maximum vertex degree, triangle aspect-ratio and maximum stretching rate for the triangulation. In addition to tile output triangulations for a variety of CAD parts, tile discussion presents related theoretical results which assert the existence of such all angle bound, and demonstrate that maximum bounds of between 25 deg and 30 deg may be achieved in practice.

Author

*Computational Fluid Dynamics; Computer Aided Design; Triangulation*



**20030007901** Institute for Computer Applications in Science and Engineering, Hampton, VA USA

**Wholly Aromatic Ether-imides. Potential Materials for n-Type Semiconductors Final Report**

Dingemans, Theo J., Institute for Computer Applications in Science and Engineering, USA; St.Clair, Terry L., NASA Langley Research Center, USA; Samulski, Edward T., North Carolina Univ., USA; December 2002; 29p; In English; Original contains color illustrations

Contract(s)/Grant(s): NAS1-97046; NCC1-02037; RTOP 505-90-52-01

Report No.(s): NASA/CR-2002-212135; NAS 1.26:212135; ICASE-2002-47; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We report on the synthesis and characterization of a novel series low-molar-mass ether-imide rod-shaped model compounds. All ether-imides were obtained by terminating the appropriate rigid core dianhydride, i.e. pyromellitic dianhydride (PMDA), 1,4,5,8-naphthalenetetracarboxylic dianhydride (NDA), 3,3',4,4'-biphenyltetracarboxylic dianhydride (BPDA), and 3,3,4,4'-oxydiphthalic dianhydride (ODPA) with three flexible aryl-ether tails of different chain length. The mono-functional aryl-ether amines, i.e. 4-(3-phenoxy-phenoxy)-phenylamine (2) and 4-(3-phenoxy-3-phenoxy-phenoxy)-phenylamine (4), were synthesized using standard fluoro-displacement and Ullmann condensation techniques. The corresponding ether-imide model compounds were obtained in high yields using a one-step solution imidization procedure. Increasing the number of meta-substituted aryl-ether units reduces the melt transition temperatures and at the same time it increases the solubility of the model compounds. Most model compounds are crystalline solids and form isotropic melts upon heating. 2,7-Bis-(4-phenoxy-phenyl)-benzo[Imn][3,8]phenanthroline 1,3,6,8-tetraone (NDA-n0), however, displays a smectic A (SA) when cooled from the isotropic phase, followed by what appears to be either a highly ordered smectic phase or a, columnar phase. This is the first example, known to date, in which a mesophase is detected in a wholly aromatic ether-imide compound. For all compounds we present spectroscopic data and X-ray diffraction data. Cyclic voltammetry was used to determine the redox behavior and pertinent energy levels of the model compounds.

Author

*Ethers; Imides; Synthesis (Chemistry); Aromatic Compounds; N-Type Semiconductors*

**20030007920** NASA Langley Research Center, Hampton, VA USA

**An Exact Dual Adjoint Solution Method for Turbulent Flows on Unstructured Grids**

Nielsen, Eric J., NASA Langley Research Center, USA; Lu, James, Massachusetts Inst. of Tech., USA; Park, Michael A., NASA Langley Research Center, USA; Darmofal, David L., Massachusetts Inst. of Tech., USA; [2003]; 12p; In English; 41st AIAA Aerospace Sciences Meeting and Exhibit, 6-9 Jan. 2003, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 2003-0272; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

An algorithm for solving the discrete adjoint system based on an unstructured-grid discretization of the Navier-Stokes equations is presented. The method is constructed such that an adjoint solution exactly dual to a direct differentiation approach is recovered at each time step, yielding a convergence rate which is asymptotically equivalent to that of the primal system. The new approach is implemented within a three-dimensional unstructured-grid framework and results are presented for inviscid, laminar, and turbulent flows. Improvements to the baseline solution algorithm, such as line-implicit relaxation and a tight coupling of the turbulence model, are also presented. By storing nearest-neighbor terms in the residual computation, the dual scheme is computationally efficient, while requiring twice the memory of the flow solution. The scheme is expected to have a broad impact on computational problems related to design optimization as well as error estimation and grid adaptation efforts.

Author

*Unstructured Grids (Mathematics); Computational Fluid Dynamics; Turbulent Flow; Algorithms; Discretization (Mathematics); Differentiators; Problem Solving*

**20030009551** Institute for Computer Applications in Science and Engineering, Hampton, VA USA

**Analysis of Composite Skin-Stiffener Debond Specimens Using Volume Elements and a Shell/3D Modeling Technique Final Report**

Krueger, Ronald, Institute for Computer Applications in Science and Engineering, USA; Minguet, Pierre J., Boeing Co., USA; October 2002; 38p; In English

Contract(s)/Grant(s): NAS1-97046; RTOP 505-90-52-01

Report No.(s): NASA/CR-2002-211947; NAS 1.26:211947; ICASE-2002-38; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

The debonding of a skin/stringer specimen subjected to tension was studied using three-dimensional volume element modeling and computational fracture mechanics. Mixed mode strain energy release rates were calculated from finite element results using the virtual crack closure technique. The simulations revealed an increase in total energy release rate in the immediate vicinity of the free edges of the specimen. Correlation of the computed mixed-mode strain energy release rates along the delamination front contour with a two-dimensional mixed-mode interlaminar fracture criterion suggested that in spite of peak total energy release rates at the free edge the delamination would not advance at the edges first. The qualitative prediction of the shape of the delamination front was confirmed by X-ray photographs of a specimen taken during testing. The good correlation between prediction based on analysis and experiment demonstrated the efficiency of a mixed-mode failure analysis for the investigation of skin/stiffener separation due to delamination in the adherents. The application of a shell/3D modeling technique for the simulation of skin/stringer debond in a specimen subjected to three-point bending is also demonstrated. The global structure was modeled with shell elements. A local three-dimensional model, extending to about three specimen thicknesses on either side of the delamination front was used to capture the details of the damaged section. Computed total strain energy release rates and mixed-mode ratios obtained from shell/3D simulations were in good agreement with results obtained from full solid models. The good correlations of the results demonstrated the effectiveness of the shell/3D modeling technique for the investigation of skin/stiffener separation due to delamination in the adherents.

Author

*Three Dimensional Models; Skin (Structural Member); Fracture Mechanics; Stiffness; Stringers; Debonding (Materials); Composite Materials; Finite Volume Method*

**20030010277** Institute for Computer Applications in Science and Engineering, Hampton, VA USA

**Higher Order Time Integration Schemes for the Unsteady Navier-Stokes Equations on Unstructured Meshes**

Jothiprasad, Giridhar, Cornell Univ., USA; Mavriplis, Dimitri J., Institute for Computer Applications in Science and Engineering, USA; Caughey, David A., Cornell Univ., USA; [2002]; 16p; In English; 32nd AIAA Fluid Dynamics Conference and Exhibit, 24-26 Jun. 2002, Saint Louis, MO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): NAG1-97046

Report No.(s): AIAA Paper 2002-2734; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright under grant NAG1-97046; Distribution as joint owner in the copyright under grant NAG1-97046

The rapid increase in available computational power over the last decade has enabled higher resolution flow simulations and more widespread use of unstructured grid methods for complex geometries. While much of this effort has been focused on steady-state calculations in the aerodynamics community, the need to accurately predict off-design conditions, which may involve substantial amounts of flow separation, points to the need to efficiently simulate unsteady flow fields. Accurate unsteady flow simulations can easily require several orders of magnitude more computational effort than a corresponding steady-state simulation. For this reason, techniques for improving the efficiency of unsteady flow simulations are required in order to make such calculations feasible in the foreseeable future. The purpose of this work is to investigate possible reductions in computer time due to the choice of an efficient time-integration scheme from a series of schemes differing in the order of time-accuracy, and by the use of more efficient techniques to solve the nonlinear equations which arise while using implicit time-integration schemes. This investigation is carried out in the context of a two-dimensional unstructured mesh laminar Navier-Stokes solver.

Derived from text

*Unstructured Grids (Mathematics); Unsteady Flow; Navier-Stokes Equation; Boundary Layer Separation*

**20030011345** Massachusetts Inst. of Tech., Cambridge, MA USA

**On the Pathways of the Return Flow of the Meridional Overturning Circulation in the Tropical Atlantic**

Jochum, Markus; Jun. 2002; 141p; In English; Prepared in cooperation with Woods Hole Oceanographic Institution, MA

Contract(s)/Grant(s): N00014-98-1-0881; NAG5-7194

Report No.(s): AD-A408850; MIT/WHOI-2002-09; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

A numerical model of the tropical Atlantic ocean is used to investigate the upper layer pathways of the Meridional Overturning Circulation (MOC) in the tropical Atlantic. The main focus of this thesis is on those parts of the tropical circulation that are thought to be important for the MOC return flow, but whose dynamics have not been understood yet. It is shown how the particular structure of the tropical gyre and the MOO act to inhibit the flow of North Atlantic water into the equatorial thermocline. As a result, the upper layers of the tropical Atlantic are mainly fed by water from the South Atlantic. The processes that carry the South Atlantic water across the tropical Atlantic into the North Atlantic as part of the MOO are described here, and three processes that were hitherto not understood are explained as follows: The North Brazil Current rings are created as the result of the reflection of Rossby waves at the South American coast. These Rossby waves are generated by the barotropically unstable North Equatorial Countercurrent. The deep structure of the rings can be explained by merger of the wave's anticyclones with the deeper intermediate

eddies that are generated as the intermediate western boundary current crosses the equator. The bands of strong zonal velocity in intermediate depths along the equator have hitherto been explained as intermediate currents. Here, an alternative interpretation of the observations is offered: The Eulerian mean flow along the equator is negligible and the observations are the signature of strong seasonal Rossby waves. The previous interpretation of the observations can then be explained as aliasing of the tropical wave field. The Tsuchiya Jets are driven by the Eliassen-Palm flux of the tropical instability waves. The equatorial current system with its strong shears is unstable and generates tropical instability waves.

DTIC

*Ocean Currents; Flow Distribution*

**20030011356** Air Force Research Lab., Air Vehicles Directorate, Wright-Patterson AFB, OH USA

**Numerical Simulations and Control of the Flow Past a Circular Cylinder**

Xiao, Ming Qing; Lin, Yuan; Camphouse, R. C.; Myatt, James H.; Banda, Siva S.; Dec. 2002; 14p; In English; Original contains color images; Prepared in collaboration with Dept. of Mathematics, Southern Illinois Univ., Carbondale, IL

Report No.(s): AD-A408897; AFRL-VA-WP-TP-2002-328; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A numerical method for a finite difference approach has been established for the analysis and control of the fluid behavior of flow past a cylinder. The discretization of the 2D Navier-Stokes equations is done over a staggered grid, convective terms in the momentum equations are handled using a mixture of central differences and donor-cell discretization, and the Poisson equations for the pressure is solved through the successive overrelaxation (SOR) method. We also study some open-loop and closed-loop control of the flow field by rotating the cylinder. For the open-loop design, we mainly make use of the energy method, and for the feedback design both the energy method and the phase method are applied.

DTIC

*Control; Finite Difference Theory; Fluid Flow*

**20030011361** Pennsylvania State Univ., Applied Research Lab., University Park, PA USA

**Sensor Flow-Induced Self Noise Reduction *Final Report***

Lauchle, G. C.; Park, S.; Oct. 16, 2002; 20p; In English

Contract(s)/Grant(s): N00014-00-G-0058

Report No.(s): AD-A408916; PSU/ARL/TR-02-016; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Boundary-layer transition and the fully-developed turbulent boundary are important contributors to sensor flow-induced self noise. The wall pressure fluctuations caused by these shear flows can be attenuated by localized fluid injection. Presented here is a vehicle forebody design concept that permits water to be injected into the transition region and adjacent turbulent boundary layer at prescribed volumetric flow rates. The injection flow rate may be tailored by a variable thickness porous shell made from powdered metal, or from a variable distribution of micro-hole perforations. Pressure to cause the injection is provided by the vehicle dynamic head. Up to 10 dB reduction of flow-induced self noise of sensors mounted in this forebody is demonstrated in small water tunnel tests.

DTIC

*Noise Reduction; Flow Noise; Water Injection*

**20030011402** NASA Glenn Research Center, Cleveland, OH USA

**Stirring Up an Elastic Fluid: Critical Viscosity of Xenon-2 (CVX-2)**

Berg, Robert F., National Inst. of Standards and Technology, USA; Moldover, Michael R., National Inst. of Standards and Technology, USA; Zimmerli, Gregory A., NASA Glenn Research Center, USA; STS 107 Shuttle Press Kit: Providing 24/7 Space Science Research; Dec. 16, 2002, pp. 71-72; In English; Also announced as 20030011376; Original contains color illustrations  
Report No.(s): NASA/FS-2002-06-069-MSFC; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Whipped cream stays in place even when turned upside down. Yet it readily flows through the nozzle of a spray can to reach the dessert plate. This demonstrates the phenomenon of shear thinning that is important to many industrial and physical processes. Paints, film emulsions, and other complex solutions that are highly viscous under normal conditions but become thin and flow easily under shear forces. A simple fluid, such as water, does not exhibit shear thinning under normal conditions. Very close to the liquid-vapor critical point, where the distinction between liquid and vapor disappears, the fluid becomes more complex and is predicted to display shear thinning. At the critical point, xenon atoms interact over long distances in a classical model of cooperative phenomena. Physicists rely on this system to learn how long-range order arises. The Critical Viscosity of Xenon Experiment (CVX-2) will measure the viscous behavior of xenon, a heavy inert gas used in flash lamps and ion rocket engines, at its critical point. Although it does not easily combine with other chemicals, its viscosity at the critical point can be used as a model for a range of fluids. Viscosity originates from the interactions of individual molecules. It is so complicated that, except

for the simplest gas, it cannot be calculated accurately from theory. Tests with critical fluids can provide key data, but are limited on Earth because critical fluids are highly compressed by gravity. CVX-2 employs a tiny metal screen vibrating between two electrodes in a bath of critical xenon. The vibrations and how they dampen are used to measure viscosity. CVX flew on STS-85 (1997), where it revealed that, close to the critical point, the xenon is partly elastic: it can 'stretch' as well as flow. For STS-107, the hardware has been enhanced to determine if critical xenon is a shear-thinning fluid.

Author

*Spaceborne Experiments; Critical Point; Xenon; Viscosity*

## 35

### INSTRUMENTATION AND PHOTOGRAPHY

*Includes remote sensors; measuring instruments and gauges; detectors; cameras and photographic supplies; and holography. For aerial photography see 43 Earth Resources and Remote Sensing. For related information see also 06 Avionics and Aircraft Instrumentation; and 19 Spacecraft Instrumentation.*

**20030007862** Paul Scherrer Inst., Villigen, Switzerland

#### **The XMM-Newton View of Stellar Coronae: High-Resolution X-Ray Spectroscopy of Capella**

Audard, M., Paul Scherrer Inst., Switzerland; Behar, E., Columbia Univ., USA; Guedel, M., Paul Scherrer Inst., Switzerland; Raassen, A. J. J., Space Research Organization Netherlands, Netherlands; Porquet, D., Commissariat a l'Energie Atomique, France; Mewe, R., Space Research Organization Netherlands, Netherlands; Foley, C. A., Mullard Space Science Lab., UK; Bromage, G. E., University of Central Lancashire, Preston, UK; Sep. 30, 2000; 6p; In English

Contract(s)/Grant(s): NAS5-31429; SNSF-21-49343.96; Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

We present the high-resolution RGS spectrum of the bright stellar binary Capella observed by the XMM-Newton satellite. A multi-thermal approach has been applied to fit the data and derive elemental abundances. The differential emission measure distribution is reconstructed using a Chebychev polynomial fit. The DEM shape is found to display a sharp peak around 7 MK, consistent with previous EUVE and ASCA results. A small but significant amount of emission measure is required around 1.8 MK in order to explain the O VII He-like triplet and the C VI Ly(alpha) line. Using the sensitivity to temperature of dielectronic recombination lines from O VI around 22 A, we confirm that the cool plasma temperature needs to be higher than 1.2 MK. In the approximation of a cool plasma described by one temperature, we used line ratios from the forbidden, intercombination, and resonance lines of the O VII triplet and derived an average density for the cool coronal plasma at the low density limit. A tentative study of line ratios from the M XI triplet gives an average temperature close to the sharp peak in emission measure and an average density of the order of  $10^{12}$  cm<sup>-3</sup>, three orders of magnitude higher than for O VII. Implications for the coronal physics of Capella are discussed. We complement this paper with a discussion of the importance of the atomic code uncertainties on the spectral fitting procedure.

Author

*X Ray Spectroscopy; Spectra; Stars; Plasma Temperature; Plasma Density; Coronas*

**20030007871** NASA Glenn Research Center, Cleveland, OH USA

#### **Development of SiC Gas Sensor Systems**

Hunter, G. W., NASA Glenn Research Center, USA; Neudeck, P. G., NASA Glenn Research Center, USA; Okojie, R. S., NASA Glenn Research Center, USA; Beheim, G. M., NASA Glenn Research Center, USA; Thomas, V., Ohio Aerospace Inst., USA; Chen, L., Ohio Aerospace Inst., USA; Lukco, D., QSS Group, Inc., USA; Liu, C. C., Case Western Reserve Univ., USA; Ward, B., Case Western Reserve Univ., USA; Makel, D., Makel Engineering, Inc., USA; October 2002; 24p; In English; 201st Meeting, 12-17 May 2002, Philadelphia, PA, USA; Sponsored by Electrochemical Society, Inc., USA

Contract(s)/Grant(s): RTOP 721-26-53

Report No.(s): NASA/TM-2002-211707; NAS 1.15:211707; E-13455; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Silicon carbide (SiC) based gas sensors have significant potential to address the gas sensing needs of aerospace applications such as emission monitoring, fuel leak detection, and fire detection. However, in order to reach that potential, a range of technical challenges must be overcome. These challenges go beyond the development of the basic sensor itself and include the need for viable enabling technologies to make a complete gas sensor system: electrical contacts, packaging, and transfer of information from the sensor to the outside world. This paper reviews the status at NASA Glenn Research Center of SiC Schottky diode gas sensor development as well as that of enabling technologies supporting SiC gas sensor system implementation. A vision of a



complete high temperature microfabricated SiC gas sensor system is proposed. In the long-term, it is believed that improvements in the SiC semiconductor material itself could have a dramatic effect on the performance of SiC gas sensor systems.

Author

*Silicon Carbides; Gas Detectors; Technology Assessment*

**20030007919** California Univ., Space Sciences Lab., Berkeley, CA USA

**Reflection Grating Array Associated with the Reflection Grating Spectrometer Developed by the Space Research Organization of the Netherlands for the X-ray Multi-Mirror Mission (XMM) Final Report**

Kahn, Steven M., California Univ., USA; Apr. 25, 2001; 6p; In English

Contract(s)/Grant(s): NAG5-31429; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The University of California, Berkeley (UCB) served as the Principal Investigator institution for the USA participation in the development of the Reflection Grating Spectrometer (RGS) which included the design, development, fabrication, and testing of the Reflection Grating Assembly (RGA). UCB was assisted in this role by the Lawrence Livermore National Laboratory and Columbia University who provided the primary facilities, materials, services and personnel necessary to complete the development. UC Berkeley's Dr. Steven Kahn provided the technical and scientific oversight for the design, development and testing of the RGA units by monitoring the performance of the units at various stages in their development. Dr. Kahn was also the primary contact with the Space Research Organization of the Netherlands (SRON) and represented the RGA development at all SRON and European Space Agency (ESA) reviews of the RGA status. In accordance with the contract, the team designed and developed novel optical technology to meet the unique requirements of the RGS. The ESA XMM-Newton Mission carries two identical Reflection Grating Spectrometers (RGS) behind two of its three nested sets of Wolter I type mirrors. The instrument allows high-resolution measurements in the soft X-ray range (6 to 38 angstroms or 2.1 to 0.3 keV) with a maximum effective area of about 140 sq cm at 15 angstroms. Its design is optimized for the detection of the K-shell transitions of carbon, nitrogen, oxygen, neon, magnesium, and silicon, as well as the L shell transitions of iron. The RGA itself consists of two units. A structure for each unit was designed to hold up to 220 gratings. In its final configuration, one unit holds 182 gratings and the second hold 181 gratings. Derived from text

*Spectrometers; Technology Assessment; High Resolution; Mirrors*

**20030010456** Air Force Research Lab., Kirkland AFB, NM USA

**640 X 486 Long-Wavelength Two-Color GaAs/AlGaAs Quantum Well Infrared Photodetector (QWIP) Focal Plane Array Camera**

Gunapala, S. D.; Bandara, S. V.; Singh, A.; Liu, J. K.; Rafol, S. B.; Jan. 13, 2000; 10p; In English

Contract(s)/Grant(s): Proj-2305

Report No.(s): AD-A408670; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

We have designed and fabricated an optimized long-wavelength/very-long-wavelength two-color quantum well infrared photodetector (QWIP) device structure. The device structure was grown on a 3-in semi-insulating GaAs substrate by molecular beam epitaxy (MBE). The wafer was processed into several 640 x 486 format monolithically integrated 8-9 and 14-15 micrometers two-color (or dual wavelength) QWIP focal plane arrays (FPA's). These FPA's were then hybridized to 640 x 486 silicon CMOS readout multiplexers. A thinned (i.e., substrate removed) FPA hybrid was integrated into liquid helium cooled dewar for electrical and optical characterization and to demonstrate simultaneous two-color imagery. The 8-9 micrometers detectors in the FPA have shown background limited performance (BLIP) at 70 K operating temperature for 300 K background with f/2 cold stop. The 14-15 micrometers detectors of the SPA reach BLIP at 40 K operating temperature under the same background conditions. In this paper we discuss the performance of this long-wavelength dualband QWIP SPA in terms of quantum efficiency, detectivity, noise equivalent temperature difference (NE DELTA T), uniformity, and operability.

DTIC

*Aluminum Gallium Arsenides; Cameras; CMOS; Color; Focal Plane Devices; Infrared Radiation; Photometers; Quantum Wells*

**20030011252** Ioffe (A. F.) Physical-Technical Inst., Saint Petersburg, Russia

**Novel Aspects of Holographic Technologies and Applications Based on New Stationary and Dynamic Holographic Recording Media Final Report, 1 Jun. 2001-1 Jun 2002**

Semenova, Irina; Jun. 2002; 32p; In English; Original contains color images

Report No.(s): AD-A408693; ISTC-2057P; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report results from a contract tasking of the Ioffe Institute as follows: Historically Russian holographic research laboratories developed many unique materials having no analogs in other countries. This effort leverages that expertise and investigates two aspects related to correction of distortion of laser communications signals: 1. Development of the technique for



compensation of atmospheric distortions in laser communication systems by means of dynamic holograms. We expect that depending upon the chosen holographic medium the following operational characteristics are attainable: Duration of a write/read/erase cycle - 1.0 msecond; Quality of correction - 80%; Improvement of the signal to noise ratio - 90%. The device will be automatic, real-time and reliable. 2. Development of a new holographic material based on self-developing dichromated colloids, for recording of stationary volume holograms. This task will include measurement of the optical effects caused by photo induced structural changes and hopes to achieve a resolution of up to 5000 l/mm and sensitivity down to 100 mJ/cm<sup>2</sup>.

DTIC

*Holography; Atmospheric Lasers; Optical Communication; Telecommunication*

**20030011284** OPTOPAL Panoramic Metrology Consulting, Budapest, Hungary

**CNN-coupled Humanoid Panoramic Annular Lens (PAL)-Optical System for Military Applications (Feasibility Study) Final Report, 20 Oct. 2000-20 Dec. 2001**

Greguss, Pal; Jan. 08, 2002; 16p; In English; Original contains color images

Contract(s)/Grant(s): F61775-01-W-E009

Report No.(s): AD-A408695; No Copyright; Avail: Defense Technical Information Center (DTIC)

This report results from a contract tasking OPTOPAL Panoramic Metrology Consulting as follows: This investigation will consist of adaptation of a Hungarian-developed single-piece imaging block, the Panoramic Annular Lens (PAL) and the CNN chip for a few military applications. A polar beam splitter will be placed immediately after the relay lens to obtain two image planes, one will be used by the existing 64X64 CNN-UM focal plane array processor chip. The other image plane will be projected on the space-variant CMOS retina-like digital camera GIOTTO. Using this configuration enables us to compensate for the relatively low pixel number of the CNN-UM array processor; further it will allow a real time switching from log-polar imaging to regular imaging and allow for the design of the humanoid PAL optical system.

DTIC

*Digital Cameras; Focal Plane Devices; Metrology; Military Technology; Imaging Techniques*

**20030011372** Brown Univ., Dept. of Geological Science, Providence, RI USA

**Review of the ISM Instrument and Results**

Mustard, John F., Brown Univ., USA; Workshop on Spectroscopy of the Martian Surface: What Next?; 2002; 2p; In English; Also announced as 20030011363; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Detailed descriptions of the ISM instrument are provided. The ISM instrument is a scanning imaging spectrometer that covers the spectral range 0.76 to 3.16 micrometers. For each pixel, 128 spectral measurements are acquired simultaneously. A 2-dimensional image of the surface was obtained by rotating the entrance mirror to scan in the cross track direction for the image samples and the forward motion of the spacecraft provides the image lines. The spectral dispersion is obtained by using a grating, whose the first and second orders are exploited. These two orders are separated by a beam-splitter and filters, and measured by four groups of 32 cooled PbS detectors, designated first and second order odd and even. Extensive evaluation of data quality and integrity has shown that the even detectors are superior overall to the odd detectors. Therefore the even channels for the first and second order are used which results in 64 channel spectra for each pixel. The signal to noise of these data is extremely high and averages greater than 500:1 for data from 0.77 to 1.51 micrometers and 1.68 to 2.6 micrometers. The detector sensitivity drops off slightly at the extremes of the wavelength ranges, but only drops below 100:1 at wavelengths longer than 2.6 micrometers.

Author

*Imaging Spectrometers; Mineralogy; Spacecraft Instruments; Scanning; Detectors*

**20030011373** Brown Univ., Dept. of Geological Sciences, Providence, RI USA

**Aladdin Instruments at Mars**

Pieters, Carle M., Brown Univ., USA; Mustard, John F., Brown Univ., USA; Murchie, Scott L., Johns Hopkins Univ., USA; Workshop on Spectroscopy of the Martian Surface: What Next?; 2002; 2p; In English; Also announced as 20030011363; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The primary goal of the Aladdin Discovery mission is to obtain samples from both satellites of Mars and to characterize the geology of these two small bodies in detail. Aladdin carries a suite of remote sensing instruments designed to map the surface composition of the satellites and to place the samples in geologic context. While Aladdin is in the Mars environment, there is also ample opportunity to acquire valuable spectroscopic data for Mars. Aladdin carries substantial memory (32 Gb) which allows storage of large amounts of Mars remote sensing data. The mission sequence allows transmission of this data to be spread over the active period at Mars plus the return journey to Earth. A near-lossless hyperspectral compression algorithm will allow

acquisition and downlink of at least 52 Gb (uncompressed) of hyperspectral imaging data. The prime mission activities occur in 2005; an overall mission summary can be found in Pieters et al. (1999, LPSC 30).

Derived from text

*Mars Surface; Planetary Geology; Remote Sensing; Mars Environment; Mineralogy; Spacecraft Instruments*

**20030011374** Aerospace Corp., Space and Environment Technology Center, El Segundo, CA USA

**Use of Thermal Hyperspectral Imagery in Terrestrial Surface Characterization**

Young, Stephen J., Aerospace Corp., USA; Workshop on Spectroscopy of the Martian Surface: What Next?; 2002; 1p; In English; Also announced as 20030011363; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Hyperspectral imagery collected in the LWIR atmospheric window region from 8 to 13 micrometers with the Aerospace Corporation's SEBASS sensor have been used in preliminary assessments of terrestrial surface characterization. Example applications will be presented showing the capability for soil and mineral identification and mapping. An overview of the mathematical algorithms employed will be included. For terrestrial applications, best results are always obtained using target spectra obtained from samples collected from the survey site. Variations of the method suitable for unobtainable site samples will be illustrated and discussed.

Author

*Imagery; Sensors; Algorithms; Planetary Surfaces; Thermal Emission*

**20030011476** Yale Univ., Dept. of Physics, New Haven, CT USA

**Mobile Atomic Gravity Gradiometer Prototype Instrument (MAGGPI) Final Report, Sep. 2001-Sep 2002**

Kasevich, Mark; Sep. 2002; 6p; In English

Contract(s)/Grant(s): F19628-01-C-0064; AF Proj. N1MA

Report No.(s): AD-A408579; AFRL-VS-TR-2002-1645; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

During the one year of active development, Yale established subprograms to develop four key instrument systems. They were: (1) field-ready laser systems (involving the design and construction of a ruggedized, portable laser system), (2) control electronics systems (developed the digital and analog electronics systems required to control each accelerometer sensor), (3) UHV vacuum system (developed prototype ultra-high vacuum systems based on all-glass sealing techniques, and (4) platform motion simulation and control. For the latter, Yale evaluated the vibration environment in several candidate motion platforms. It also determined the specs for a suitable six-degree of freedom motion actuation system and developed a system concept and requirements for platform stabilization and control to achieve the required vibration environment for sensor operation. The detailed work related to each of these four instrument systems will not be present. The Principal Investigator accepted a position at Stanford University. A new contract will be started there and the effort will continue.

DTIC

*Detectors; Gravitation; Interferometers; Gradiometers; Atom Optics*

## 36

## LASERS AND MASERS

*Includes lasing theory, laser pumping techniques, maser amplifiers, laser materials, and the assessment of laser and maser outputs. For cases where the application of the laser or maser is emphasized see also the specific category where the application is treated. For related information see also 76 Solid-State Physics.*

**20030010518** Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

**Power Scaling Feasibility or Chromium-Doped II-VI Laser Sources and the Demonstration of a Chromium-Doped Zinc Selenide Face-Cooled Disk Laser**

McKay, Jason B.; Mar. 2002; 177p; In English

Report No.(s): AD-A408929; AFIT/DS/ENP/02-05; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

Tunable lasers in the 2-4 mm wavelength range are needed for Air Force sensor applications. Chromium-doped II-VI materials are a promising class of laser material for tunable operation in this wavelength range, but until recently had not produced enough output power to meet application requirements. This dissertation investigates Cr<sup>2+</sup>:II-VI material properties and potential laser designs, then experimentally demonstrates and analyzes the performance of a Cr<sup>2+</sup>:ZnSe disk laser design that can produce sufficient output power. Cr<sup>2+</sup>:II-VI laser materials are found to be susceptible to overheating and thermal lensing, but are otherwise satisfactory laser materials. The most feasible laser design given a 15 W pump power limit was a face-cooled disk laser design using Cr<sup>2+</sup>:ZnSe. The experimental implementation of the laser design produced 4.3 W. However, the experimental laser

worked well only under a restricted set of conditions, due to thermal lensing caused by a radially non-uniform absorbed power distribution in the laser disk. Design modifications are discussed which should reduce thermal lensing to acceptable levels. The conclusion is that Cr<sup>2+</sup>:II-VI laser sources can produce enough power for Air Force sensor applications, if enough effort is spent on ensuring adequate thermal management in the laser material.

DTIC

*Tunable Lasers; Laser Materials; Doped Crystals; Zinc Selenides*

**20030011315** Air Force Research Lab., Space Vehicles Directorate, Kirkland AFB, NM USA

**Characterization of Vapour Plume Species and Deposition Residues Resulting from Pulsed Laser Ablation of a Graphite/Epoxy Composite**

Roybal, R. E.; Miglionico, C. J.; Stein, C.; Murr, L. E.; Lincoln, K. A.; Jan. 1995; 10p; In English

Contract(s)/Grant(s): AF Proj. 2303

Report No.(s): AD-A408676; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A modified time-of-flight mass spectrometer fitted with a special collection stage for carbon-coated transmission electron microscope specimen grids is used to monitor laser-pulse ablation products from graphite/epoxy composite targets. Scanning electron microscopy observations show ablation damage to consist of matrix pyrolysis, fibre fracture and spallation of fragments which include elemental hydrogen, carbon epoxide and acetylene groups. Transmission electron microscope examination of specimen grids showed a variety of crystals and polycrystalline hexagonal graphites having a wide range of shapes including spheres and faceted polyhedra and platelets, textured flake structures, microrosettes. These observations lend some credibility to a model for laser-shock and pyrolysis effects which create molecular plume fragments and deposition fragments of hexagonal graphite.

DTIC

*Laser Beams; Graphite-Epoxy Composites; Ablation; Pulsed Lasers*

**20030011321** Stanford Univ., High Temperature Gasdynamics Lab., Stanford, CA USA

**Next Generation Diode Lasers for Wavelength Multiplexed Propulsion Sensors Final Report, 15 Mar. 2001-14 Sep. 2002**

Hanson, R. K.; Sep. 15, 2002; 4p; In English

Contract(s)/Grant(s): F49620-01-1-0229; AF Proj. 3484

Report No.(s): AD-A408659; AFRL-SR-AR-TR-02-0374; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Equipment listed in the report was purchased under the Department of Defense University Research Instrumentation Program (DURIP).

DTIC

*Propellants; Laser Spectroscopy; Semiconductor Lasers*

**20030011457** Northrop Grumman Corp., Information Technology, San Antonio, TX USA

**Laser Threat Analysis System (LTAS), 2.0 Final Report, 1995-2002**

Pfaltz, John M.; Richardson, Christina E.; Ruiz, Abel; Barsalou, Norman; Thomas, Robert J.; Nov. 2002; 136p; In English

Contract(s)/Grant(s): F41924-97-D-9000; AF Proj. 3257

Report No.(s): AD-A408798; AFRL-HE-BR-TR-2002-0108; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

LTAS is a totally integrated modeling and simulation environment designed for the purpose of ascertaining the susceptibility of Air Force pilots and air crews to optical radiation threats. Using LTAS, mission planners can assess the operational impact of optically directed energy weapons and countermeasures. Through various scenarios, threat analysts are able to determine the capability of laser threats and their impact on operational missions including the air crew's ability to complete their mission effectively. Additionally, LTAS allows the risk of laser use on training ranges and the requirement for laser protection to be evaluated. LTAS gives mission planners and threat analysts complete control of the threat environment including threat parameter control and placement, terrain mapping (line-of-site), atmospheric conditions, and laser eye protection (LEP) selection. This report summarizes the design of the final version of LTAS, and the modeling methodologies implemented to accomplish analysis.

DTIC

*Flight Crews; Radiation Protection; Eye Protection*

**20030011520** Veridian Engineering, Inc., Arlington, VA USA

**Biological Effects of Directed Energy Final Report, Apr. 1997-Apr 2002**

Dayton, Thomas; Beason, Charles; Hitt, M. K.; Rogers, Walter; Cook, Michael; Nov. 2002; 60p; In English

Contract(s)/Grant(s): F41624-96-C-9009; AF Proj. 7757

Report No.(s): AD-A408809; AFRL-HE-BR-TR-2002-0226; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This Final Report summarizes the biological effects research conducted by Veridian Engineering personnel under contract F41624-96-C-9009 in support of the Air Force Research Laboratory's Radio Frequency Radiation Branch from April 1997 to April 2002. Biological effects research and consultation were provided in five major areas: Active Denial System (also known as Vehicle Mounted Active Denial System), radio frequency radiation (RFR) health and safety, non-lethal weapon biological effects research, the newly formed Joint Non-Lethal Weapons Human Effects Center of Excellence, and Biotechnology. The report is organized by research efforts within the major research areas, providing title, objective, a brief description, relevance to the AF or DoD, funding, and products.

DTIC

*Biological Effects; Biotechnology; Radiation Protection*

**20030011531** Foundation for Research and Technology-Hellas, Iraklion, Crete, Greece

**Nanocomposite Random Lasers Final Report**

Piperaki, K.; Stasinopoulos, A.; Anglos, D.; Anastasiadis, S. H.; Giannelis, E. P.; Nov. 26, 2002; 16p; In English; Original contains color images

Report No.(s): AD-A408870; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report results from a contract tasking FORTH, Foundation for Research & Technology--Hellas as follows: The contractor will synthesize polymer nanocomposite materials and will investigate their properties appropriate to developing a new generation of flexible lasers. The contractor will develop composites by: incorporating semiconductor nanoparticles (ZnO, ZnS, ZnSe, and others) into inert polymer matrices; by incorporating high refractive index nanoparticles (TiO<sub>2</sub>, BaTiO<sub>3</sub>, and others) into fluorescent conjugated polymers; and by synthesizing nanocomposites using commercially available nonlinear polymers. The contractor will deposit synthesized nanocomposites onto various surfaces and will characterize their dispersion characteristics, viscoelastic properties, and optical properties for lasing.

DTIC

*Polymers; Composite Materials; Lasers*

**20030011535** Applied Optoelectronics, Inc., Sugar Land, TX USA

**Compact, High Power, Multi-Spectral Mid-Infrared Semiconductor Laser Package Final Report, 1 Feb. 2001-31 Jul. 2002**

Guo, Bujin; Hwang, Wen-Yen; Lin, Chich-Hsiang; Oct. 2001; 72p; In English; Original contains color images

Contract(s)/Grant(s): F29601-00-2-0058

Report No.(s): AD-A408878; AFRL-DE-TR-2002-1050; No Copyright; Avail: Defense Technical Information Center (DTIC)

Through a vertically integrated effort involving atomic level material engineering, advanced device processing development, state-of-the-art optomechanical packaging, and thermal management, Applied Optoelectronics, Inc. (AOI), University of Houston (U H), and Physical Science, Inc. (PSI) have made progress in both Sb-based type-II semiconductor material and in P-based type-I laser device development. We have achieved record performance on InP based quantum cascade continuous wave (CW) laser (with more than 5 mW CW power at 210 K). Grating-coupled external-cavity quantum cascade lasers were studied for temperatures from 20 to 230 K. A tuning range of 88 nm has been obtained at 80 K. The technology can be made commercially available and represents a significant milestone with regard to the Dual Use Science and Technology (DUST) intention of fostering dual use commercial technology for defense need. AOI is the first commercial company to ship products of this licensed technology.

DTIC

*Semiconductor Lasers; Quantum Electronics; Laser Materials; Continuous Wave Lasers*



37  
**MECHANICAL ENGINEERING**

*Includes mechanical devices and equipment; machine elements and processes. For cases where the application of a device or the host vehicle is emphasized see also the specific category where the application or vehicle is treated. For robotics see 63 Cybernetics, Artificial Intelligence, and Robotics; and 54 Man/System Technology and Life Support.*

**20030010288** Oxford Univ., Dept. of Engineering Science, Oxford UK

**An Investigation of the Motion of Spring Suspended Pistons *Final Report***

Davey, Gordon; Dadd, Mike; Bailey, Paul; Oct. 18, 2002; 36p; In English; Original contains color images

Contract(s)/Grant(s): F61775-00-WE027

Report No.(s): AD-A408638; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report describes the investigation of the modeling and construction of low vibration mechanical compressors, such as used in cryogenic coolers. The classic 'Oxford' cryocooler has a clearance seal between the piston and the cylinder which is maintained by the use of spiral disc springs. In a typical compressor this clearance is about 12 microns, and therefore the spring suspension system must have a linearity of no more than 3 or 4 microns to avoid contact. It has always been assumed that to maintain this linearity, the surfaces between which the springs are clamped must be very flat and very parallel to each other. It has also been assumed that the flatness and parallel-ness of the clamping at the inside of the spring is more important than at the outside. We investigate how the linearity of motion is dependent on the clamping conditions of the springs. Tests were carried out on a typical suspension system which was deliberately assembled between non-parallel clamping surfaces, and the linearity of the resulting motion was measured. A simple theoretical model was developed which gives good agreement with the experimental results.

DTIC

*Compressors; Cryogenic Cooling; Pistons; Mechanical Properties; Springs (Elastic); Suspending (Hanging); Motion; Mathematical Models*

**20030011300** Virginia Polytechnic Inst. and State Univ., Center for Intelligent Material Systems and Structures, Blacksburg, VA USA

**Smart Structures for Vibration Suppression of Optical Surfaces *Final Report, 1 Apr. 1999-30 Sep. 2002***

Inman, Daniel J.; Oct. 25, 2002; 11p; In English

Contract(s)/Grant(s): F49620-99-1-0231

Report No.(s): AD-A408578; AFRL-SR-AR-TR-02-0401; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Our objective addresses the mechanics models needed and the suppression techniques offered by smart materials as applied to optical systems mounted on satellites. The objectives of this research effort are to model the dynamics and control of flexible optical systems for both vibration suppression and shape control using smart materials as the actuation component and sensing component. The specific objective was to model a generic system, select suitable actuation, sensing and control elements, develop a system model, and verify the results against a proof-of-concept experiment. The results of this three-year grant can be summarized as follows: 1) Actuator Material Selection; 2) Ground Testing of an Inflated Torus; Finite Element Modeling; 3) Mechanics Modeling; 4) Comparison of Inflated Torus Models and Tests; and 5) Control Analysis: a) Theoretical Designs; b) Experimental Implementations and Verifications. All of the results developed here center around a thin membrane material (Kapton) formed into an inflated torus. A torus forms one of the basic elements of the perceived inflated satellite reflector system. The research results have focused on generic results applied to the specific case of an inflated torus. The inflated torus was chosen because it is a basic element being considered by AFRL (Air Force Research Laboratory).

DTIC

*Optical Equipment; Vibration; Beams (Supports); Damping; Piezoelectricity; Flexible Bodies*

**20030011326** Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA

**Weld Strength Verification and Proposed Weld Testing and Inspection Criteria for the MK83 and MK84 Conical Bomb Fins *Final Report***

Pepi, Marc S.; Champagne, Victor K.; Oct. 2002; 74p; In English

Report No.(s): AD-A408616; ARL-TR-2862; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The U.S. Army Research Laboratory (ARL) performed weld strength verification testing on manufactured specimens to characterize four different types of welds found on both the MK83 and MK84 conical bomb fins. Based on the results obtained by testing, as well as existing requirements, ARL established test and inspection criteria that may be employed at the discretion

of the Naval Air Warfare Center for future First Article Inspections and/or during production as a tool for evaluating the quality and integrity of the weldments.

DTIC

*Weld Strength; Welded Joints*

**20030011343** Naval Postgraduate School, Monterey, CA USA

**Summary of Research 2000, Department of Mechanical Engineering**

McNelley, Terry R.; Kwon, Young; Dec. 2001; 61p; In English

Report No.(s): AD-A408841; NPS-09-02-009; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report contains project summaries of the research projects in the Department of Mechanical Engineering. A list of recent publications is also included, which consists of conference presentations and publications, books, contributions to books, published journal papers, and technical reports. Thesis abstracts of students advised by faculty in the Department are also included.

DTIC

*Mechanical Engineering; Military Technology; Research and Development*

## 38

### QUALITY ASSURANCE AND RELIABILITY

*Includes approaches to, and methods for reliability analysis and control, inspection, maintainability, and standardization.*

**20030007842** NASA Langley Research Center, Hampton, VA USA

**Development and Flight Testing of an Adaptive Vehicle Health-Monitoring Architecture**

Woodard, Stanley E., NASA Langley Research Center, USA; Coffey, Neil C., NASA Langley Research Center, USA; Gonzalez, Guillermo A., NASA Langley Research Center, USA; Taylor, B. Douglas, Swales Aerospace, USA; Brett, Rube R., ZIN Technologies, Inc., USA; Woodman, Keith L., NASA Langley Research Center, USA; Weathered, Brenton W., NASA Langley Research Center, USA; Rollins, Courtney H., NASA Langley Research Center, USA; [2002]; 26p; In English; Aircraft Technology, Integration and Operations 2002 Technical Forum, 1-3 Oct. 2002, Los Angeles, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 2002-5802; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

On going development and testing of an adaptable vehicle health-monitoring architecture is presented. The architecture is being developed for a fleet of vehicles. It has three operational levels: one or more remote data acquisition units located throughout the vehicle; a command and control unit located within the vehicle, and, a terminal collection unit to collect analysis results from all vehicles. Each level is capable of performing autonomous analysis with a trained expert system. The expert system is parameterized, which makes it adaptable to be trained to both a user's subject reasoning and existing quantitative analytic tools. Communication between all levels is done with wireless radio frequency interfaces. The remote data acquisition unit has an eight channel programmable digital interface that allows the user discretion for choosing type of sensors; number of sensors, sensor sampling rate and sampling duration for each sensor. The architecture provides framework for a tributary analysis. All measurements at the lowest operational level are reduced to provide analysis results necessary to gauge changes from established baselines. These are then collected at the next level to identify any global trends or common features from the prior level. This process is repeated until the results are reduced at the highest operational level. In the framework, only analysis results are forwarded to the next level to reduce telemetry congestion. The system's remote data acquisition hardware and non-analysis software have been flight tested on the NASA Langley B757's main landing gear. The flight tests were performed to validate the following: the wireless radio frequency communication capabilities of the system, the hardware design, command and control; software operation and, data acquisition, storage and retrieval.

Author

*Systems Health Monitoring; Aircraft Equipment; Life (Durability); Fault Detection; Systems Engineering; Data Acquisition; Command and Control; Architecture (Computers); Flight Tests*

39  
**STRUCTURAL MECHANICS**

*Includes structural element design, analysis and testing; dynamic responses of structures; weight analysis; fatigue and other structural properties; and mechanical and thermal stresses in structure. For applications see 05 Aircraft Design, Testing and Performance and 18 Spacecraft Design, Testing and Performance.*

**20030007723** NASA Langley Research Center, Hampton, VA USA

**Buckling Behavior of Long Anisotropic Plates Subjected to Elastically Restrained Thermal Expansion**

Nemeth, Michael P., NASA Langley Research Center, USA; [2002]; 41p; In English; 43rd AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference, 22-25 Apr. 2002, Denver, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 2002-1731; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution under U.S. Government purpose rights; Distribution under U.S. Government purpose rights

An approach for synthesizing buckling results for, and behavior of, thin balanced and unbalanced symmetric laminates that are subjected to uniform heating or cooling and elastically restrained against thermal expansion or contraction is presented. This approach uses a nondimensional analysis for infinitely long, flexurally anisotropic plates that are subjected to combined mechanical loads and is based on useful nondimensional parameters. In addition, stiffness-weighted laminate thermal-expansion parameters and compliance coefficients are derived that are used to determine critical temperatures in terms of physically intuitive mechanical-buckling coefficients. The effects of membrane orthotropy and membrane anisotropy are included in the general formulation. Many results are presented for some common laminates that are intended to facilitate a structural designer's transition to the use of generic buckling design curves. Several curves that illustrate the fundamental parameters used in the analysis are presented, for nine contemporary material systems, that provide physical insight into the buckling response in addition to providing useful design data. Examples are presented that demonstrate the use of generic design curves. The analysis approach and generic results indicate the effects and characteristics of elastically restrained laminate thermal expansion or contraction, membrane orthotropy and anisotropy, and flexural orthotropy and anisotropy in a very general and unifying manner.

Author

*Buckling; Anisotropic Plates; Thermal Expansion; Elastic Properties; Laminates*

**20030007727** Clarkson Univ., Div. of Research, Potsdam, NY USA

**Test-Free Fracture Toughness Final Report, 1 Jul. 2000 - 30 Sep. 2002**

Minnetyan, Levon, Clarkson Univ., USA; January 2003; 83p; In English

Contract(s)/Grant(s): NAG3-2394; Proj. 375-32634; Proj. 375-563; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Computational simulation results can give the prediction of damage growth and progression and fracture toughness of composite structures. The experimental data from literature provide environmental effects on the fracture behavior of metallic or fiber composite structures. However, the traditional experimental methods to analyze the influence of the imposed conditions are expensive and time consuming. This research used the CODSTRAN code to model the temperature effects, scaling effects and the loading effects of fiberbraided composite specimens with and without fiber-optic sensors on the damage initiation and energy release rates. The load-displacement relationship and fracture toughness assessment approach is compared with the test results from literature and it is verified that the computational simulation, with the use of established material modeling and finite element modules, adequately tracks the changes of fracture toughness and subsequent fracture propagation for any fiberbraided composite structure due to the change of fiber orientations, presence of large diameter optical fibers, and any loading conditions.

Author

*Fracture Mechanics; Fracture Strength; Fiber Orientation; Computerized Simulation; Applications Programs (Computers); Toughness*

**20030010294** NASA Langley Research Center, Hampton, VA USA

**An Efficient and Robust Singular Value Method for Star Pattern Recognition and Attitude Determination**

Juang, Jer-Nan, NASA Langley Research Center, USA; Kim, Hye-Young, Texas A&M Univ., USA; Junkins, John L., Texas A&M Univ., USA; January 2003; 22p; In English; Original contains color illustrations

Contract(s)/Grant(s): RTOP 258-30-10-02

Report No.(s): NASA/TM-2003-212142; NAS 1.26:212142; L-18251; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A new star pattern recognition method is developed using singular value decomposition of a measured unit column vector matrix in a measurement frame and the corresponding cataloged vector matrix in a reference frame. It is shown that singular values and right singular vectors are invariant with respect to coordinate transformation and robust under uncertainty. One advantage of singular value comparison is that a pairing process for individual measured and cataloged stars is not necessary, and the attitude estimation and pattern recognition process are not separated. An associated method for mission catalog design is introduced and simulation results are presented.

Author

*Attitude (Inclination); Pattern Recognition; Stars; Simulation; Recognition; Dimensional Measurement*

**20030011482** NASA Langley Research Center, Hampton, VA USA

**On Generating Fatigue Crack Growth Thresholds**

Forth, Scott C., NASA Langley Research Center, USA; Newman, James, Jr., Mississippi State Univ., USA; Forman, Royce G., NASA Johnson Space Center, USA; International Journal of Fatigue; 2003; ISSN 0142-1123; Volume 25, pp. 9-15; In English; Copyright; Avail: Issuing Activity

The fatigue crack growth threshold, defining crack growth as either very slow or nonexistent, has been traditionally determined with standardized load reduction methodologies. These experimental procedures can induce load history effects that result in crack closure. This history can affect the crack driving force, i.e. during the unloading process the crack will close first at some point along the wake or blunt at the crack tip, reducing the effective load at the crack tip. One way to reduce the effects of load history is to propagate a crack under constant amplitude loading. As a crack propagates under constant amplitude loading, the stress intensity factor range, Delta K, will increase, as will the crack growth rate,  $da/dN$ . A fatigue crack growth threshold test procedure is experimentally validated that does not produce load history effects and can be conducted at a specified stress ratio, R. The authors have chosen to study a ductile aluminum alloy where the plastic deformations generated during testing may be of the magnitude to impact the crack opening.

Author

*Fatigue (Materials); Crack Propagation; Loads (Forces); Aluminum Alloys*

**20030011558** Air Force Research Lab., Propulsion Directorate West, Edwards AFB, CA USA

**Overdeterministic Fracture Analysis and Singular Value Decomposition**

Miller, Timothy C.; Chona, Ravinder; Jun. 1999; 27p; In English; Presented at SEM Spring Conference, held in Cincinnati, OH, in Jun. 1999. Prepared in cooperation with Texas A&M Univ., Dept. of Mechanical Engineering, College Station, TX. Viewgraphs only

Contract(s)/Grant(s): Proj-2302

Report No.(s): AD-A408643; AFRL-PR-ED-TP-FY99-0124; No Copyright; Avail: Defense Technical Information Center (DTIC)

No abstract.

DTIC

*Decomposition; Fracture Mechanics*

**20030011560** Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

**Fracture Mechanics Research at Air Force Research Laboratory**

Miller, T. C.; Dec. 05, 2000; 15p; In English

Contract(s)/Grant(s): Proj-2302

Report No.(s): AD-A408648; AFRL-PR-ED-TP-2000-227; AFRL-PR-ED-TP-2000-227; No Copyright; Avail: Defense Technical Information Center (DTIC)

Viewgraphs from presentation given to Swedish diplomats during a visit to the Air Force Research Lab, Edwards AFB, CA, in December 2000.

DTIC

*Fracture Mechanics; Mechanical Properties; Research and Development; Solid Propellant Rocket Engines*



42  
**GEOSCIENCES (GENERAL)**

*Includes general research topics related to the Earth sciences, and the specific areas of petrology, mineralogy, and general geology. For other specific topics in geosciences see categories 41 through 48.*

**20030007713** State Univ. of New York, Multidisciplinary Center for Earthquake Engineering Research, Buffalo, NY USA  
**Engineering and Organizational Issues Related to The World Trade Center Terrorist Attack, Volume 3, Emergency Response in the Wake of the World Trade Center Attack: The Remote Sensing Perspective**

Huyck, C. K.; Adams, B. J.; Jun. 2002; 62p; In English

Report No.(s): PB2003-101512; MCEER-02-SP05-Vol-3; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

A combination of factors culminated in a breakthrough for remote sensing technology in emergency management, following the events of September 11th. First, the World Trade Center attack is an event unparalleled in history. The devastation was beyond the imaginative capabilities of emergency management professionals - there was simply no appropriate script for such an event. The demand for information proved to be immense. Second, Manhattan is unique in the USA because of the density of high-rise buildings and the value of real estate. Because of this, and the logistical needs that follow, the City of New York had already undertaken intense mapping efforts, resulting in the production of highly accurate vector and raster databases. Third, even though this was a very large disaster, the scale of events in New York was highly localized, with primary impacts concentrated in a small geographic area. The need to coordinate the response for an event of this magnitude, in a dense yet relatively small area, made the combination of imagery and data maps particularly useful.

NTIS

*Remote Sensing; Terrorism; Emergencies; Planning; Attacking (Assaulting); Data Bases*

**20030007770** Natural Resources Conservation Service, Washington, DC USA

**Sampling Vegetation Attributes: Interagency Technical Reference**

1999; 176p; In English

Report No.(s): PB2003-101901; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

This interagency technical reference provides the basis for consistent, uniform, and standard vegetation attribute sampling that is economical, repeatable, statistically reliable, and technically adequate. While not all inclusive, this reference does include the primary vegetation sampling methods used across the West (frequency methods, dry weight rank method, Daubenmire, line intercept, density method, comparative yield, etc.).

NTIS

*Vegetation; Sampling; Standards*

**20030007773** North Carolina State Univ., Dept. of Biological and Agricultural Engineering, Raleigh, NC USA

**Predicting Long-Term Wetland Hydrology from Hydric Soil Field Indicators**

Vepraskas, M. J.; He, X.; Lindbo, D. L.; Skaggs, R. W.; Aug. 2002; 78p; In English

Report No.(s): PB2003-100208; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Current regulations governing wetland identification make it virtually impossible to identify freshwater wetland routinely using current technology. Jurisdictional wetlands include areas that are saturated within 30 cm of the surface for 5% of the growing season in 5 or more years out of 10. Such information on wetland hydrology can be obtained by long-term monitoring studies that span both wet and dry years. These require long periods of time (5 to 10 years) to complete, and are too expensive to do at most sites where the information is needed. An alternative approach is to use hydrologic models to estimate water table data over long periods at a few bench-mark sites. These data can be obtained quickly (in less than 6 months). The hydrologic information can be extrapolated to other soils by calibrating soil indicators of saturation for the specific frequencies and durations of saturation estimated by the model. These indicators (basically seen as gray and red colors) occur in most wetland soils that are chemically reduced and can be easily identified during on-site inspections. by using hydrologic models in combination with hydric soil indicators, we should be able to estimate quickly and economically how long the major soils are saturated in the Coastal Plain region of North Carolina.

NTIS

*Hydrology; Wetlands; Long Term Effects; Soils; Predictions*

**20030007780** Geological Survey, Water Resources Div., Rolla, MO USA

**Ground-Water Monitoring Plan, Water Quality, and Variability of Agricultural Chemicals in the Missouri River Alluvial Aquifer near the City of Independence, Missouri, Well Field, 1998-2000**

Kelly, B. P.; 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM

Report No.(s): PB2003-100563; USGS/WRI-02-4096; No Copyright; Avail: National Technical Information Service (NTIS)

A detailed ground-water sampling plan was developed and executed for 64 monitoring wells in the city of Independence well field to characterize ground-water quality in the 10-year zone of contribution. Samples were collected from monitoring wells, combined Independence well field pumpage, and the Missouri River at St. Joseph, Missouri, from 1998 through 2000.

NTIS

*Ground Water; Monitors; Water Management; Water Quality; Alluvium; Rivers*

**20030007798** Geological Survey, Alaska Biological Sciences Center, Anchorage, AK USA

**Geologic Guide to Wrangell-Saint Elias National Park and Preserve, Alaska. A Tectonic Collage of Northbound Terranes**

Winkler, G. R.; 2000; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM.

Report No.(s): PB2003-101095; USGS-PP-1616; No Copyright; Avail: National Technical Information Service (NTIS)

Contents: The Present Tectonic Setting of Southern Alaska-Key to the Past; Wrangell-Saint Elias-A Collage of Geologic Terranes; Windy Terrane-Diced Pieces of the Continental Backstop; Gravina-Nutzotin Belt-Jurassic and Cretaceous Adhesive; Wrangellia-The First of its Type; Alexander Terrane-Basement for the Archipelago; Chugach and Prince William Terranes-Acretionary Processes on Edge; and Yakutat Terrane-The Latest to Arrive; The Dynamic Parklands-Continually Reshaped by Earthquakes, Volcanoes, and Glacier; Gold and Copper-Or Was it Copper and Gold; Geological Sketches of a Few Notable Spots; The Nabasna Road; Cooper Pass and the Totschunda Fault System; Chitistone Gorge-The Goat Trail-Skolai Pass; Volcanoes of the Wrangell and Saint Elias Mountains; Copper River Canyon-Copper River Basin; The McCarthy Road; Kinnicott Glacier and Kennicott River; Tebay Lakes; Bagley Ice Field; Icy Bay; Malaspina Glacier; and Disenchantment Bay-Hubbard Glacier-Russell Fiord.

NTIS

*Alaska; National Parks; Geology; Glaciers; Tectonics*

**20030007799** Geological Survey, Water Resources Div., Oklahoma City, OK USA

**Surface-Water Characteristics and Quality on the Osage Reservation, Osage County, Oklahoma, 1999**

Abbott, M. M.; Tortorelli, R. L.; 2002; 78p; In English

Report No.(s): PB2003-101205; USGS/WRI-02-4060; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Concern about the effects of early oil-industry practices of surface disposal of produced-brine water prompted an investigation of the surface-water quality on the Osage Reservation. About 38,600 oil wells have been drilled on the Osage Reservation since drilling began in 1896. The Osage Reservation comprises three major drainage basins. The Caney River Basin is in the northeast, the Bird Creek Basin is in the southeast, and the Salt Creek Basin in the west. Variations in streamflow on the Osage Reservation during a year primarily result from variations in the quantity and frequency of rainfall, evapo-transpiration, and reservoir operations.

NTIS

*Water Quality; Oklahoma; Surface Water; Pollution Control; Oils; Wells*

**20030007800** Arizona State Univ., Dept. of Chemical, Biological, and Materials Science Engineering, Tempe, AZ USA

**Carrier-Gas Enhanced Atmospheric Pressure Desalination Final Report**

Beckman, J. R.; Oct. 2002; 88p; In English

Report No.(s): PB2003-101361; DRDP-92; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The technology, Dewvaporation, investigated involves the desalination of seawater and brackish water, which may find immediate economic niche in small plant applications. Larger facilities will develop with time.

NTIS

*Water Treatment; Costs; Bromides; Lithium; Desalinization*

**20030007801** Forest Service, Pacific Northwest Research Station, Portland, OR USA

**Stereo Photo Series for Quantifying Natural Fuels: Grassland, Shrubland, Woodland, and Forest Types in Hawaii**

Wright, C. S.; Ottmar, R.; Vihnanek, R. E.; Weise, D. R.; Mar. 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM.

Report No.(s): PB2003-101369; FSGTR-PNW-545; No Copyright; Avail: National Technical Information Service (NTIS)

Single and stereo photographs display a range of natural conditions and fuel loadings in grassland, woodland, and forest types in Hawaii. Each group of photos includes inventory information summarizing vegetation composition, structure, and loading, and as appropriate, woody material loading and various site characteristics. The natural fuels photo series is designed to help land managers appraise fuel and vegetation conditions in natural settings.

NTIS

*Wood; Biomass; Hawaii; Photographs; Fuels; Natural Gas; Forests*

**20030007803** Interagency Task Force on Floodplain Management, Washington, DC USA

**Blueprint for Change. Sharing the Challenge: Floodplain Management Into the 21st Century**

2002; 276p; In English

Report No.(s): PB2003-101468; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche

In January 1994 you assigned the Review Committee the mission to delineate the major causes and consequences of the 1993 Midwest flooding; to evaluate the performance of existing floodplain management and related watershed management programs. The Review Committee also was to make recommendations to the Task Force on changes in current policies, programs, and activities of the federal government that most effectively would achieve risk reduction, economic efficiency, and environmental enhancement in the floodplain and related watersheds. The report provides the Review Committee's findings and recommendations for action.

NTIS

*Floods; Forecasting; Flood Plains; Watersheds; Blueprints*

**20030011274** Norfolk State Univ., BEST Lab., VA USA

**Norfolk State University Research Experience in Earth System Science Final Report, 1 Sep. 1997 - 31 Jul. 2002**

Chaudhury, Raj, Norfolk State Univ., USA; [2002]; 11p; In English

Contract(s)/Grant(s): NAG5-6298

Report No.(s): NRA-96-MTPE-07; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The truly interdisciplinary nature of Earth System Science lends itself to the creation of research teams comprised of people with different scientific and technical backgrounds. In the annals of Earth System Science (ESS) education, the lack of an academic major in the discipline might be seen as a barrier to the involvement of undergraduates in the overall ESS-enterprise. This issue is further compounded at minority-serving institutions by the rarity of departments dedicated to Atmospheric Science, Oceanography or even the geosciences. At Norfolk State University, a Historically Black College, a six week, NASA-supported, summer undergraduate research program (REESS - Research Experience in Earth System Science) is creating a model that involves students with majors in diverse scientific disciplines in authentic ESS research coupled with a structured education program. The project is part of a wider effort at the University to enhance undergraduate education by identifying specific areas of student weaknesses regarding the content and process of science. A pre- and post-assessment test, which is focused on some fundamental topics in global climate change, is given to all participants as part of the evaluation of the program. Student attitudes towards the subject and the program's approach are also surveyed at the end of the research experience. In 2002, 11 undergraduates participated in REESS and were educated in the informed use of some of the vast remote sensing resources available through NASA's Earth Science Enterprise (ESE). The program ran from June 3rd through July 12, 2002. This was the final year of the project.

Derived from text

*Earth Sciences; Education; Remote Sensing; NASA Space Programs; Research and Development*

## EARTH RESOURCES AND REMOTE SENSING

*Includes remote sensing of earth features, phenomena and resources by aircraft, balloon, rocket, and spacecraft; analysis or remote sensing data and imagery; development of remote sensing products; photogrammetry; and aerial photographs. For instrumentation see 35 Instrumentation and Photography.*

**20030007806** Bureau of Land Management, National Applied Resource Sciences Center, Denver, CO USA

**Utilization Studies and Residual. Interagency Technical Reference. 1999 Revision**

1999; 178p; In English

Report No.(s): PB2003-101907; BLM/RS/ST-96/004-1730; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

This interagency technical reference provides the basis for consistent, uniform, and standard utilization studies and residual measurements that are economical, repeatable, statistically reliable, and technically adequate. While not all inclusive, this reference does include the primary study methods used across the West (twig length measurement, stubble height, comparative yield, paired plot, ocular estimate, key species, height weight, etc.).

NTIS

*Vegetation; Surveys; Dimensional Measurement*

**20030007807** Geological Survey, National Water-Quality Assessment Program, Reston, VA USA

**Trace Elements and Organic Compounds in Streambed Sediment and Fish Tissue of Coastal New England Streams, 1998-99 Final Report**

Chalmers, A.; 2002; 40p; In English

Report No.(s): PB2003-101912; USGS-WRI-02-4179; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Streambed sediment and fish tissue were collected at 14 river sites in eastern New England during low-flow conditions in 1998 and 1999 as part of the New England Coastal Basins (NECB) study of the U.S. Geological Survey National Water-Quality Assessment (NAWQA) Program. Sampling sites were selected over a range of urban settings. Population densities at selected sites ranged from 26 to 3,585 people per square mile, and urban land use ranged from 1 to 68 percent. The streambed sediment samples were analyzed for a total of 141 contaminants, including 45 trace elements, 32 organochlorine compounds, and 64 semi-volatile organic compounds. The fish tissue samples were analyzed for 22 trace elements and 28 organochlorine compounds.

NTIS

*Trace Elements; Water Quality; Sediments; Volatile Organic Compounds; Organic Compounds*

**20030010290** Lunar and Planetary Inst., Houston, TX USA

**First Use of an Airborne Thermal Infrared Hyperspectral Scanner for Compositional Mapping**

Kirkland, Laurel, Lunar and Planetary Inst., USA; Herr, Kenneth, Aerospace Corp., USA; Keim, Eric, Aerospace Corp., USA; Adams, Paul, Aerospace Corp., USA; Salisbury, John, Johns Hopkins Univ., USA; Hackwell, John, Aerospace Corp., USA; Treiman, Allan, Lunar and Planetary Inst., USA; Remote Sensing of Environment; 2002; ISSN 0034-4257; Volume 80, pp. 447-459; In English; Original contains color illustrations

Contract(s)/Grant(s): NASW-4574; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In May 1999, the airborne thermal infrared hyperspectral imaging system, Spatially Enhanced Broadband Array Spectrograph System (SEBASS), was flown over Mon-non Mesa, NV, to provide the first test of such a system for geological mapping. Several types of carbonate deposits were identified using the 11.25 microns band. However, massive calcrete outcrops exhibited weak spectral contrast, which was confirmed by field and laboratory measurements. Because the weathered calcrete surface appeared relatively smooth in hand specimen, this weak spectral contrast was unexpected. Here we show that microscopic roughness not readily apparent to the eye has introduced both a cavity effect and volume scattering to reduce spectral contrast. The macroroughness of crevices and cobbles may also have a significant cavity effect. The diminished spectral contrast is important because it places higher signal-to-noise ratio (SNR) requirements for spectroscopic detection and identification. This effect should be factored into instrumentation planning and interpretations, especially interpretations without benefit of ground truth. SEBASS had the required high SNR and spectral resolution to allow us to demonstrate for the first time the ability of an airborne hyperspectral thermal infrared scanner to detect and identify spectrally subtle materials.

Author

*Thermal Mapping; Surface Roughness; Spectroscopy; Spectral Resolution; Infrared Imagery; Scanners*



**20030011375** Cornell Univ., Ithaca, NY USA

**Fifty Years of Mars Surface and Atmospheric Composition from Telescopes: Highlights and Implications for Spacecraft Studies**

Bell, J., Cornell Univ., USA; Workshop on Spectroscopy of the Martian Surface: What Next?; 2002; 2p; In English; Also announced as 20030011363; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The modern era of Mars telescopic studies began shortly after World War II, with Gerard Kuiper's spectroscopic discovery of CO<sub>2</sub> in the Martian atmosphere. Other early studies included measurements of Martian water vapor, searches for infrared spectral features from organics, discovery of hydrated mineral absorption features in the near-infrared, and characterization of the detailed visible-wavelength spectral reflectance properties of the surface materials. Improvements in telescopes and detectors over the years have yielded associated improvements in spatial and spectral range, resolution, and SNR. This talk will review a number of important findings that have come from these studies, including both atmospheric composition and surface mineralogy. Also discussed will be more recent findings and controversies, especially on surface mineralogy, that have come from even higher spectral resolution near-IR telescopic observations and higher spatial resolution HST observations.

Derived from text

*Mars Surface; Telescopes; Mars Atmosphere; Spectroscopy; Mars (Planet); Infrared Radiation*

**20030011505** Hydrologic Engineering Center, Davis, CA USA

**Mississippi Basin Modeling System Development and Application**

Dobberpuhl, Stu; Burant, John; Nanda, S. K.; Farhat, Jody; Pridal, Dan; Feb. 1998; 41p; In English; Original contains color images Report No.(s): AD-A408587; HEC-PR-36; No Copyright; Avail: Defense Technical Information Center (DTIC)

This report describes the history and status of the Mississippi Basin Modeling System development and application. Within this report, the term "model development" is sometimes used to describe software development and sometimes to describe data; i.e., its acquisition, preparation and use in the UNET modeling system and for calibration adjustments. The context of the use will clarify the distinction. Implementation of the UNET modeling system and ancillary software for real-time forecasting is described. Coordinations and collaborations that were essential to the success of the effort are reported. Data acquisition, calibration of the modeling systems, and its use for real-time forecasting are summarized.

DTIC

*Computer Programs; Mississippi River (US); Missouri River (US)*

**20030011525** Pacific Science and Engineering Group, Inc., San Diego, CA USA

**Evaluating Alternative Symbolologies for Decluttering Geographical Displays**

St. John, M.; Feher, B. A.; Morrison, J. G.; Aug. 2002; 17p; In English; Original contains color images Contract(s)/Grant(s): N66001-99-D-0050

Report No.(s): AD-A408836; TR-1890; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Reducing the clutter on geographical displays should help military decision-makers manage their attention and concentrate on the most important or threatening tracks. This report presents a study that considered the question of how the decluttered tracks should be represented. The declutter symbols must simultaneously reduce distraction while still supporting situation awareness. We used a visual search task to evaluate six declutter symbolologies. The symbolologies were created by manipulating two factors, symbol type and coloring. The symbol types were relatively complex MIL-STD-2525B symbols that coded substantial information about the tracks, simplified outlines of ships and aircraft that coded an intermediate amount of information, and simple dots that coded minimal information. The coloring factor consisted of using either faded versions of the MIL-STD-2525B colors or using gray. We also investigated the effect of different amounts of declutter, from no declutter to 25% declutter, 50% declutter, and 75% declutter. The participants were 52 undergraduate students from local universities. Participants searched for two target symbols among a field of 48 symbols that were a mixture of fully visible, brightly colored MIL-STD-2525B symbols and decluttered symbols. The targets always appeared among the fully visible symbols, and the decluttered symbols merely served as distracters. Each increase in the amount of declutter produced a significant and linear drop in search time. The intermediately complex symbol outlines produced the least distraction and the fastest search times, but the differences among symbol types were small. Surprisingly, the faded colored symbols produce as little distraction and as fast search times as the gray symbols.

DTIC

*Symbols; Display Devices; Software Development Tools*

## ENERGY PRODUCTION AND CONVERSION

*Includes specific energy conversion systems, e.g., fuel cells; and solar, geothermal, windpower, and waterwave conversion systems; energy storage; and traditional power generators. For technologies related to nuclear energy production see 73 Nuclear Physics. For related information see also 07 Aircraft Propulsion and Power; 20 Spacecraft Propulsion and Power, and 28 Propellants and Fuels.*

**20030007784** Swedish Defence Research Establishment, Aeronautics Div., Stockholm Sweden

**Swedish Wind Energy Research Program VKK, Annual Report 2000/2001** *Vindkraftsprogrammet VKK Laegesrapport verksamhetsaret 2000/2001.*

Thor, S. E.; Nov. 2001; In Swedish; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM.

Report No.(s): PB2003-101025; FOI-R-0185-SE; No Copyright; Avail: National Technical Information Service (NTIS)

This report describes the results that have been achieved during the period July 1, 2000 to June 30, 2001.

NTIS

*Windpower Utilization; Research Projects*

## ENVIRONMENT POLLUTION

*Includes atmospheric, water, soil, noise, and thermal pollution.*

**20030007681** Faucett (Jack) Associates, Inc., Western Regional Office, Walnut Creek, CA USA

**Heavy-Duty Vehicle Fleet Characterization of Reduction of NO<sub>x</sub> and Particulate Matter Emissions in the South Coast Air Basin** *Final Report*

Fischer, M.; May 2002; 92p; In English

Report No.(s): PB2003-100863; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This report presents findings in a research project that studies heavy-duty vehicle (HDV) fleets and heavy-duty truck (HDT) operations in the South Coast Air Basin (SoCAB, the Basin). Because HDVs are considered to be major contributions to NO<sub>x</sub> and PM emissions in the SoCAB, HDV, HDT characteristics and their emissions need to be examined carefully in order to control their emissions more effectively.

NTIS

*Air Pollution; Trucks; Exhaust Emission*

**20030007682** California Polytechnic State Univ., Dept. of Chemistry and Biochemistry, San Luis Obispo, CA USA

**Investigation of Low Reactivity Solvents**

Censullo, A. C.; Jones, D. R.; Wills, M. T.; May 2002; 144p; In English

Report No.(s): PB2003-100865; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

The contractor prepared a database of solvent properties designed to facilitate the production of alternative lower reactive formulations for consumer products. Solvents for inclusion in the database were selected in accordance with program objectives of the Air Resources Board. Special attention was given to low reactivity solvents, in support of the ARB's reactivity-based regulation for aerosol coatings. Consideration was given to solvents that are representative of those used for products formulated for the California marketplace. Supplemental information on chemical composition was obtained for all solvent and solvent mixtures studied.

NTIS

*Aerosols; Solvents; Air Pollution*

**20030007683** California Univ., Dept. of Environmental Toxicology, Davis, CA USA

**Linkages Between Measurements of Multifunctional and Polar Organics in Chamber Studies and the Ambient Environment** *Final Report*

Charles, M. J.; Spaulding, R. S.; May 2002; 244p; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM.

Report No.(s): PB2003-100866; No Copyright; Avail: National Technical Information Service (NTIS)

This work develops and applies methods to measure oxygenated organics in aerosols and fine particulate matter: Such methods are needed to gain further insight into chemical processes affecting the generation and fate of oxidation products of

hydrocarbon emissions, and source apportionment of fine particulate matter. We establish the power of methods that rely on employment of O-(2,3,4,5,6-pentafluorobenzyl)-hydroxylamine (PFBHA) and bis(trimethylsilyl)trifluoroacetamide (BSTFA) to derivatize carbonyls and multifunctional carbonyls, and measurement of the derivatives by using gas chromatography/ion trap mass spectrometry (GC/ITMS). By using this approach, we report for the first time in the ambient atmospheric environment, the presence of hydroxyl acetone, 3-hydroxy-butanone, and 2-hydroxy-2-methylpropanal, and novel high molecular weight (>C10) oxygenated organics in PM<sub>2.5</sub> that may be tracers of diesel-particulate matter. We also establish the utility of using a mist chamber to sample water-soluble organic, with Henry's law constants greater than 10<sup>-3</sup>. We applied the method to measurements of pptv levels of isoprene and 2-methyl-3-buten-2-ol (MBO) photooxidation products in the Blodgett Forest, CA, using sampling times of 10 minutes to support the results of chamber studies.

NTIS

*Aerosols; Particulates; Air Pollution; Organic Compounds*

**20030007684** NASA Langley Research Center, Hampton, VA USA

**Active Control of Turbulent Boundary Layer Induced Sound Radiation from Multiple Aircraft Panels**

Gibbs, Gary P., NASA Langley Research Center, USA; Cabell, Randolph H., NASA Langley Research Center, USA; [2002]; 8p; In English; 8th AIAA/CEAS Aeroacoustics Conference, 16-18 Jun. 2002, Breckenridge, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Original contains color illustrations

Report No.(s): AIAA Paper 2002-2496; Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; Distribution under U.S. Government purpose rights; Distribution under U.S. Government purpose rights

The objective of this work is to experimentally investigate active structural acoustic control of turbulent boundary layer (TBL) induced sound radiation from multiple panels on an aircraft sidewall. One possible approach for controlling sound radiation from multiple panels is a multi-input/multi-output scheme which considers dynamic coupling between the panels. Unfortunately, this is difficult for more than a few panels, and is impractical for a typical aircraft which contains several hundred such panels. An alternative is to implement a large number of independent control systems. Results from the current work demonstrate the feasibility of reducing broadband radiation from multiple panels utilizing a single-input/single-output (SISO) controller per bay, and is the first known demonstration of active control of TBL induced sound radiation on more than two bays simultaneously. The paper compares sound reduction for fully coupled control of six panels versus independent control on each panel. An online adaptive control scheme for independent control is also demonstrated. This scheme will adjust for slow time varying dynamic systems such as fuselage response changes due to aircraft pressurization, etc.

Author

*Active Control; Aeroacoustics; Aircraft Structures; Panels; Noise Reduction; Controllers*

**20030007686** California Univ., Davis, CA USA

**Mechanisms of Particulate Toxicity: Effects on the Respiratory System Final Report**

Pinkerton, K. E.; Buckpitt, A. R.; Hyde, D. M.; Plopper, C. G.; Dec. 2000; 168p; In English

Report No.(s): PB2003-100862; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

Health effects seen with ambient exposure continue to be a concern for numerous stakeholders including scientists, health experts, regulators, industry, and the general public. Epidemiological studies have consistently demonstrated adverse health effects to occur with exposure to airborne particle concentrations to below the current national and international air quality standards. Sensitive individuals appear to be children, the elderly and those with pre-existing cardiopulmonary compromise. However, the precise mechanisms by which these individuals are at greater risk for morbidity and mortality are unclear. The purpose of this study was to examine the effects of acute exposure to NH<sub>4</sub>NO<sub>3</sub> and carbon, components present in the particulate matter of California, in the lungs of young, adult, and senescent rats. The authors hypothesized that epithelial cells could serve as a direct measure of particle toxicity since they are the primary cells of the respiratory tract to exhibit adverse consequences of exposure to inhaled particles and gases. The response of epithelial cells of the airway bronchial tree and alveoli could function as a sensitive guide to identify patterns of injury due to particle deposition and/or particle-mediated effects observed within anatomically distinct regions of the lungs.

NTIS

*Particulates; Toxicity; Respiratory System*

**20030007687** Statewide Air Pollution Research Center, Riverside, CA USA

**Yields and Reactions of Intermediate Compounds Formed from the Initial Atmospheric Reactions of Selected VOCs *Final Report***

Atkinson, R.; Arey, J.; Dodge, M. C.; Harger, W. P.; McElroy, P.; Apr. 2000; 142p; In English  
Report No.(s): PB2003-100861; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This contract had three project elements dealing with aspects of the atmospheric chemistry of volatile or semi-volatile organic compounds. Project Element No. 1 concerned the investigation of ambient NO<sub>3</sub> radical levels in the Los Angeles Air Basin during the 1997 Southern California Ozone Study (SCOS97-NARSTO), using the formation of nitronaphthalenes and methylnitronaphthalenes (MNNs) as a sensitive indicator of the presence of NO<sub>3</sub> radicals during nighttime. Project Element No. 2 involved the participation of Roger Atkinson in the Coordinating Research Council, Inc., Review Panel for the Atmospheric Chemistry of Hydrocarbons (RPACH). This data review panel was set up to carry out detailed reviews and evaluations of the literature data concerning the atmospheric chemistry of the various classes of VOCs of importance in photochemical air pollution, with this review and evaluation being concerned with the atmospheric chemistry of alkenes. Project Element No. 3 was the preparation of two review chapters for the North American Research in Tropospheric Ozone (NARSTO) assessment document included as part of this effort a sub-contract to Dr. Marcia C. Dodge. The two critical review papers dealt with the following topics: the current status of the kinetics, mechanisms and products of the atmospheric reactions of VOCs and NO<sub>x</sub> (Roger Atkinson); and the 'smog' chamber data-base and current programs in this area and the status of chemical mechanisms for air quality simulation models (Marcia C. Dodge).

NTIS

*Atmospheric Chemistry; Organic Compounds; Volatile Organic Compounds*

**20030007704** Automotive Testing Labs., Inc., Mesa, AZ USA

**Heavy-Duty Truck Evaporative Emissions Testing for Emissions Inventory *Final Report***

McClement, D.; Jun. 2002; 76p; In English  
Report No.(s): PB2003-100864; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Emission Factor Models are created to permit comparison of alternative strategies for reducing and maintaining ambient pollution levels. New vehicle certification testing methods were developed for light-duty cars and trucks in the 1990's. The new methods provide superior estimates of in-use evaporative emissions than those previously obtained. Little data using the new methods is available for in-use heavy-duty trucks. The purpose of this study was to measure evaporative emissions with a limited sample of the larger vehicles using the new vehicle certification protocols. The results will be used to confirm or improve corresponding Emission Factor Model inputs for this class of vehicle. Results of the testing were consistent with results obtained from light-duty vehicle when fuel tank size and vehicle age is considered.

NTIS

*Trucks; Exhaust Emission; Air Pollution*

**20030007711** National Inst. of Standards and Technology, (BFR), Gaithersburg, MD USA

**CONTAMW 2.0 User Manual: Multizone Airflow and Contaminant Transport Analysis Software**

Dols, W. S.; Walton, G. N.; Nov. 2002; 170p; In English; Also available on CD-ROM  
Report No.(s): PB2003-101676; NISTIR-6921; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

This manual describes the computer program CONTAMW version 2.0 developed by NIST. CONTAMW is a multizone indoor air quality and ventilation analysis program designed to help you determine: airflows and pressures - infiltration, exfiltration, and room-to-room airflows and pressure differences in building systems driven by mechanical means, wind pressures acting on the exterior of the building, and buoyancy effects induced by temperature differences between the building and the outside; contaminant concentrations - the dispersal of airborne contaminants transported by these airflows and transformed by a variety of processes including chemical and radio-chemical transformation, adsorption and desorption to building materials, filtration, and deposition to building surfaces; and/or personal exposure - the prediction of exposure of building occupants to airborne contaminants for eventual risk assessment.

NTIS

*Air Quality; Buildings; User Manuals (Computer Programs); Computer Programs; Ventilation*



**20030007714** Environmental Protection Agency, Chesapeake Bay Program, Annapolis, MD USA

**Recommendations for Coordinating Phosphorus-Based Nutrient Management in the Chesapeake Bay Region**

Sep. 2002; 14p

Report No.(s): PB2003-100836; EPA/903/R-02-007; CBP/TRS/265-02; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Recently, the Chesapeake Bay Program, the Natural Resource Conservation Service (NRCS) and the scientific community have begun to place a greater emphasis on the role phosphorus plays in nonpoint source pollution. This increased awareness of the risks of excess phosphorus in the soil profile and its relationship to water quality has led to NRCS guidance and Environmental Protection Agency-proposed regulations. These proposed EPA regulations would require operators to implement nutrient control practices for nitrogen and phosphorus in their farm nutrient management plans for confined animal feeding operations (CAFOs). Nutrient control practices for nitrogen and phosphorus will likely become a requirement for farms that meet certain federal criteria. Also, other federal or state programs may require new practices with respect to phosphorus. For farming operations that use only commercial fertilizers, this shift should not be burdensome. However, due to the ratio of phosphorus to nitrogen in animal wastes and biosolids, phosphorus-based nutrient management planning may be a more arduous task for livestock and poultry operations as well as for permitted sewage sludge applications.

NTIS

*Phosphorus; Water Quality; Management Planning; Resources Management; Caloric Requirements; Chesapeake Bay (US)*

**20030007732** California Univ., San Diego, CA USA

**Seasonal Atmospheric and Oceanic Predictions Final Report, 1 Mar. 1999 - 28 Feb. 2003**

Roads, John, California Univ., USA; [2003]; 14p; In English

Contract(s)/Grant(s): NAG5-8292; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Several projects associated with dynamical, statistical, single column, and ocean models are presented. The projects include: 1) Regional Climate Modeling; 2) Statistical Downscaling; 3) Evaluation of SCM and NSIPP AGCM Results at the ARM Program Sites; and 4) Ocean Forecasts.

CASI

*Ocean Models; Climatology; Cloud Physics; Predictions; Atmospheric Models; Annual Variations*

**20030007774** North Carolina Univ., Center for Marine Science Research, Wilmington, NC USA

**Seeking Science-Based Nutrient Standards for Coastal Blackwater Stream Systems**

Mallin, M. A.; Cahoon, L. B.; McIver, M. R.; Ensign, S. H.; Aug. 2002; 66p; In English

Report No.(s): PB2003-100219; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Blackwater streams are the most common lotic systems on the North Carolina Coastal Plain. Despite their abundance, these streams are rarely considered to be sensitive to nutrient loading and are usually not afforded the nutrient protection that estuaries and Piedmont-derived water bodies receive. However, recent data from the University of North Carolina at Wilmington's Lower Cape Fear River Program (LCFRP) have demonstrated that both organic and inorganic nitrogen and phosphorus loading can be high in these systems. Sources include municipal and private point-source discharges and non-point source inputs from concentrated animal feeding operations and traditional agriculture. Blackwater systems normally contain somewhat reduced dissolved oxygen relative to clearwater streams because they have contact with organic sediments in floodplain swamps, are high in bacteria, and high concentrations of dissolved organic carbon are available as substrates for bacterial respiration. Thus, blackwater streams are particularly at risk for pollution-caused hypoxia and anoxia (low dissolved oxygen stress).

NTIS

*Streams; Standards; Coasts; Sensitivity; Water Pollution; Nutritional Requirements*

**20030007793** Atmospheric and Environmental Research, Inc., Lexington, MA USA

**Impact of Climatic Variability on Atmospheric Mass Distribution and GRACE-Derived Gravity Fields Final Report, 16 Oct 2001 - 15 Dec. 2002**

Salstein, David A., Atmospheric and Environmental Research, Inc., USA; Rosen, Richard D., Atmospheric and Environmental Research, Inc., USA; Ponte, Rui M., Atmospheric and Environmental Research, Inc., USA; Jan. 15, 2003; 22p; In English; Original contains color illustrations

Contract(s)/Grant(s): NAS5-01124; NSF INT-98-07014; AER Proj. 866; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

During the period we calculated the atmospheric data sets related to its mass and angular momentum distribution. For mass, we determined the various harmonics from the NCEP-NCAR reanalysis, especially the low-order harmonics that are useful in

studying the gravitation distribution as will be determined from the GRACE mission. Atmospheric mass is also related to the atmospheric loading on the solid Earth; we cooperated with scientists who needed the atmospheric mass information for understanding its contributions to the overall loading, necessary for vertical and horizontal coordinate estimation. We calculated atmospheric angular momentum from the NCEP-NCAR reanalyses and 4 operational meteorological centers, based on the motion (wind) terms and the mass (surface pressure) terms. These are associated with motions of the planet, including its axial component causing changes in the length of day, more related to the winds, and the equatorial component related to motions of the pole, more related to the mass. Tasks related to the ocean mass and angular momentum were added to the project as well. For these we have noted the ocean impact on motions of the pole as well as the torque mechanisms that relate the transfer of angular momentum between oceans and solid earth. The activities of the project may be summarized in the following first manuscript written in December 2002, for a symposium that Dr. Salstein attended on Geodynamics. We have continued to assess ocean angular momentum (OAM) quantities derived from bottom pressure and velocity fields estimated with our finite-difference barotropic (single layer) model. Three years of output (1993-95) from a run without any data constraints was compared to output from a corresponding run that was constrained by altimeter data using a Kalman filter and smoother scheme. Respective OAM time series were combined with corresponding atmospheric series and compared to observed polar motion. The constrained OAM series provided slightly better variance reduction than the unconstrained series. Analysis provided a check on the estimation scheme and pointed to further work to improve the determination of OAM using this method. A significant effort was also devoted to quantifying effects of uncertainties in high frequency winds on the mean and seasonal momentum exchange between atmosphere and oceans.

Author

*Gravitational Fields; Air Masses; Mass Distribution; Pressure Distribution; Climatology; Angular Momentum*

**20030007805** Office of Air Quality Planning and Standards, Research Triangle Park, NC USA

**Regulatory Impact Analysis of the Proposed Reciprocating Internal Combustion Engines NESHAP Final Report**

Nov. 2002; 268p

Report No.(s): PB2003-101679; EPA/452/R-02/012; No Copyright; Avail: CASI; A12, Hardcopy; A03, Microfiche

This report summarizes the benefits and costs associated with the National Emissions Standard for Hazardous Air Pollutants (NESHAP) for the Reciprocating Internal Combustion Engines (RICE) source category. This source category includes spark ignition engines that operate generally with natural gas and compression ignition engines that operate with diesel fuel, and can be classified as two-stroke, or four-stroke engines. They are also classified by the richness of the fuel mix: rich burn or lean burn. The affected RICE units operate in a variety of markets and service industries. For instance, some are typically used along natural gas pipelines to provide adequate pressure to transmit fuel through the pipeline. Others are also used to provide power in a remote area of an operation in industries such as health services, energy generation, oil and gas extraction, and quarrying of non-metallic minerals.

NTIS

*Emission; Standards; Combustion; Combustion Chambers; Engines; Air Pollution; Pollution Control; Internal Combustion Engines*

**20030011397** NASA Goddard Space Flight Center, Greenbelt, MD USA

**Deciphering the Role of Desert Dust in the Climate Puzzle: The Mediterranean Israeli Dust Experiment (MEIDEX)**

Levin, Zev, Tel-Aviv Univ., Ramat-Aviv, Israel; Joseph, Joachim, Tel-Aviv Univ., Ramat-Aviv, Israel; Mekler, Yuri, Tel-Aviv Univ., Ramat-Aviv, Israel; Israelevich, Peter, Tel-Aviv Univ., Ramat-Aviv, Israel; Ganor, Eli, Tel-Aviv Univ., Ramat-Aviv, Israel; Hilsenrath, Ernest, NASA Goddard Space Flight Center, USA; Janz, Scott, NASA Goddard Space Flight Center, USA; STS 107 Shuttle Press Kit: Providing 24/7 Space Science Research; Dec. 16, 2002, pp. 62-63; In English; Also announced as 20030011376; Original contains color illustrations

Report No.(s): NASA/NP-2002-5-289-HQ; NAS 1.83:5-289-HQ; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Numerous studies have shown that aerosol particles may be one of the primary agents that can offset the climate warming induced by the increase in the amount of atmospheric greenhouse gases. Desert aerosols are probably the most abundant and massive type of aerosol particles that are present in the atmosphere worldwide. These aerosols are carried over large distances and have various global impacts. They interact with clouds, impact the efficiency of their rain production and change their optical properties. They constitute one of the primary sources of minerals for oceanic life and influence the health of coral reefs. They have direct effects on human health, especially by inducing breathing difficulties in children. It was lately discovered that desert particles carry pathogens from the Sahara desert over the Atlantic Ocean, a fact that may explain the migration of certain types of diseases. Aerosols not only absorb solar radiation but also scatter it, so that their climatic effect is influenced not only by their physical properties and height distribution but also by the reflectivity of the underlying surface. This latter property changes

greatly over land and is low over ocean surfaces. Aerosol plumes are emitted from discrete, sporadic sources in the desert areas of the world and are transported worldwide by the atmosphere's wind systems. For example, Saharan dust reaches Mexico City, Florida, Ireland, Switzerland and the Mediterranean region, while Asian dust reaches Alaska, Hawaii and the continental United States. This means that in order to assess its global effects, one must observe dust from space. The Space Shuttle is a unique platform, because it flies over the major deserts of our planet, enabling measurements and remote sensing of the aerosols as they travel from source to sink regions. Such efforts must always be accompanied by in-situ data for validation and calibration, with direct sampling of the airborne particles. MEIDEX is a joint project of the Israel Space Agency (ISA) and NASA, under a cooperation agreement between the two agencies.

Author

*Aerosols; Spaceborne Experiments; Israeli Space Program; Remote Sensing*

**20030011398** Department of Defense, USA

**Shuttle Ionospheric Modification with Pulsed Localized Exhaust (SIMPLEX)**

STS 107 Shuttle Press Kit: Providing 24/7 Space Science Research; Dec. 16, 2002, pp. 64; In English; Also announced as 20030011376; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

SIMPLEX is a Department of Defense experiment that observes shuttle Orbital Maneuvering System engine burns. The orbiter OMS thruster firings are used to create ionospheric disturbances for observation by the SIMPLEX radars. There is no flight hardware associated with this payload. The SIMPLEX radars are located at: 1) Arecibo, Puerto Rico, 2) Kwajalein, Marshall Islands, 3) Millstone Hill, Mass., 4) Jicamarca, Peru, and 5) the Very Large Array near Socorro, N.M. The purpose of SIMPLEX is to determine the source of Very High Frequency (VHF) radar echoes caused by the Orbiter's OMS engines. On STS-107 a burn will be performed over the VLA.

Author

*Space Shuttles; Spaceborne Experiments; Ionospheric Disturbances; Exhaust Emission; Orbit Maneuvering Engine (Space Shuttle)*

**20030011399** NASA Goddard Space Flight Center, Greenbelt, MD USA

**Looking at Ozone From a New Angle: Shuttle Ozone Limb Sounding Experiment-2 (SOLSE-2)**

McPeters, Richard, NASA Goddard Space Flight Center, USA; Hilsenrath, Ernest, NASA Goddard Space Flight Center, USA; Janz, Scott, NASA Goddard Space Flight Center, USA; STS 107 Shuttle Press Kit: Providing 24/7 Space Science Research; Dec. 16, 2002, pp. 65-66; In English; Also announced as 20030011376; Original contains color illustrations  
Report No.(s): NASA/NP-2002-3-442-GSFC; NAS 1.83:3-442-GSFC; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The ozone layer above Earth is our planet's fragile sunscreen, protecting people, vegetation, and wildlife. NASA has been measuring ozone for more than 20 years by looking down, but SOLSE-2 will show that more information is available by looking at ozone from the side, at Earth's limb or atmospheric boundary. When the ozone layer is compromised, increased ultraviolet (UV) levels from the sun cause health problems ranging from severe sunburns to skin cancer and cataracts. A concerted global effort has been made to reduce or eliminate the production of chemicals that deplete ozone, but the ozone layer is not expected to recover for many decades because these chemicals can remain active in the atmosphere for up to 100 years. We know now that ozone monitoring needs to be focused in the lower stratosphere. The discovery of the ozone hole in 1985 demonstrated that very large changes in ozone were occurring in the lower stratosphere near 20 km, instead of the upper stratosphere as first expected, and where current ozone instruments are focused. Measuring ozone from a tangential perspective that is centered at the limb provides ozone profiles concentrated in the lower stratosphere. The first flight of SOLSE proved that this technique achieves the accuracy and coverage of traditional measurements, and surpasses the altitude resolution and depth of retrieval of conventional techniques. Results from the first flight convinced the science community to design the next generation ozone monitoring satellite based on SOLSE. The Ozone Mapping and Profiling Suite (OMPS) is currently being built for the NPOESS satellite. The primary objective of SOLSE-2 is to confirm the promising results of the first flight over a wider range of viewing conditions and spectral wavelengths. Sometimes a really hard problem can be solved when you look at it from a different angle! While scientists conduct research, protect yourself by observing the UV index and spend less unprotected time outdoors.

Author

*Ozonometry; Earth Limb; Spaceborne Experiments; Sounding*

**20030011403** NASA Glenn Research Center, Cleveland, OH USA

**Tackling a Hot Paradox: Laminar Soot Processes-2 (LSP-2)**

Faeth, Gerard M., Michigan Univ., USA; Urban, David L., NASA Glenn Research Center, USA; STS 107 Shuttle Press Kit:

Providing 24/7 Space Science Research; Dec. 16, 2002, pp. 73-74; In English; Also announced as 20030011376; Original contains color illustrations

Report No.(s): NASA/FS-2002-06-072-MSFC; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The last place you want to be in traffic is behind the bus or truck that is belching large clouds of soot onto your freshly washed car. Besides looking and smelling bad, soot is a health hazard. Particles range from big enough to see to microscopic and can accumulate in the lungs, potentially leading to debilitating or fatal lung diseases. Soot is wasted energy, and therein lies an interesting paradox: Soot forms in a flame's hottest regions where you would expect complete combustion and no waste. Soot enhances the emissions of other pollutants (carbon monoxide and polyaromatic hydrocarbons, etc.) from flames and radiates unwanted heat to combustion chambers (a candle's yellowish glow is soot radiating heat), among other effects. The mechanisms of soot formation are among the most important unresolved problems of combustion science because soot affects contemporary life in so many ways. Although we have used fire for centuries, many fundamental aspects of combustion remain elusive, in part because of limits imposed by the effects of gravity on Earth. Hot or warm air rises quickly and draws in fresh cold air behind it, thus giving flames the classical teardrop shape. Reactions occur in a very small zone, too fast for scientists to observe, in detail, what is happening inside the flame. The Laminar Soot Processes (LSP-2) experiments aboard STS-107 will use the microgravity environment of space to eliminate buoyancy effects and thus slow the reactions inside a flame so they can be more readily studied. 'Laminar' means a simple, smooth fuel jet burning in air, somewhat like a butane lighter. This classical flame approximates combustion in diesel engines, aircraft jet propulsion engines, and furnaces and other devices. LSP-2 will expand on surprising results developed from its first two flights in 1997. The data suggest the existence of a universal relationship, the soot paradigm, that, if proven, will be used to model and control combustion systems on Earth. STS-107 experiments also will help set the stage for extended combustion experiments aboard the International Space Station.

Author

*Soot; Spaceborne Experiments; Laminar Flow; Microgravity*

**20030011459** NASA Langley Research Center, Hampton, VA USA

#### **Reply**

Chambers, Lin, NASA Langley Research Center, USA; Lin, Bing, NASA Langley Research Center, USA; Wielicki, Bruce, NASA Langley Research Center, USA; Hu, Yong-Xiang, NASA Langley Research Center, USA; Xu, Kuan-Man, NASA Langley Research Center, USA; [2002]; 4p; In English; Original contains color illustrations; Copyright; Avail: Issuing Activity

Chou et al. (2002, hereinafter CLH) argue in their comment that the way in which Lin et al. (2002) analyzed the Clouds and the Earth's Radiant Energy System (CERES) data (Wielicki et al. 1996) is not appropriate. The analysis in the Lin et al. paper exactly followed the original iris idea, as presented by Lindzen et al. (2001, hereinafter LCH), yet obtained significantly different results. We have repeated the analysis with some additional thresholds as illustrated in the CLH comment, and our basic conclusion remains: the difference between the net radiative fluxes of the cloudy-moist and clear-moist regions should be small. Thus, the radiative forcing resulting from a change in tropical high cloud amount is still about 1/10 of that found in LCH. Fu et al. (2002) draw a similar conclusion using a radiation model to compute the fluxes for each region.

Author

*Radiant Flux Density; Tropical Regions; Cloud Cover; Scattering; Data Processing; Cloud Physics*

## **46**

### **GEOPHYSICS**

*Includes earth structure and dynamics, aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism. For related information see 47 Meteorology and Climatology; and 93 Space Radiation.*

**20030007900** Brown Univ., Dept. of Geological Sciences, Providence, RI USA

#### **Experiments and Spectral Studies of Martian Volcanic Rocks: Implications for the Origin of Pathfinder Rocks and Soils Final Report, 1 Apr. 1999 - 30 Sep. 2002**

Rutherford, Malcolm J., Brown Univ., USA; Mustard, Jack, Brown Univ., USA; Weitz, Catherine, NASA Goddard Space Flight Center, USA; [2002]; 5p; In English

Contract(s)/Grant(s): NAG5-8181; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The composition and spectral properties of the Mars Pathfinder rocks and soils together with the identification of basaltic and andesitic Mars terrains based on Thermal Emission Spectrometer (TES) data raised interesting questions regarding the nature and origin of Mars surface rocks. We have investigated the following questions: (1) are the Pathfinder rocks igneous and is it possible these rocks could have formed by known igneous processes, such as equilibrium or fractional crystallization, operating



within SNC magmas known to exist on Mars? If it is possible, what P (depth) and PH<sub>2</sub>O conditions are required? (2) whether TES-based interpretations of plagioclase-rich basalt and andesitic terrains in the south and north regions of Mars respectively are unique. Are the surface compositions of these regions plagioclase-rich, possibly indicating the presence of old Al-rich crust of Mars, or are the spectra being affected by something like surface weathering processes that might determine the spectral pyroxene to plagioclase ratio?

Derived from text

*Mars Volcanoes; Mars Surface; Thermal Emission; Rocks; Planetary Geology*

**20030010293** NASA Johnson Space Center, Houston, TX USA

**A "Mesosiderite" Rock from Northern Siberia, Russia: Not a Meteorite**

Treiman, Allan H., Lunar and Planetary Inst., USA; Lindstrom, David J., NASA Johnson Space Center, USA; Schwandt, Craig S., Lockheed Martin Corp., USA; Franchi, Ian A., Open Univ., UK; Morgan, Matthew L., Mile High Meteorites, USA; Meteoritics and Planetary Science; 2002; Volume 37, pp. B13-B22; In English

Contract(s)/Grant(s): NAG5-8270; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A possible mesosiderite meteorite was found in the area of the Putorana Plateau, Noril'sk district, Siberia, Russia. Although this rock resembles a mesosiderite in its hand-sample aspect and in having Ni-bearing iron metal, it is not a meteorite. This inference is based on the lack of a fusion crust, the lack of cosmogenic nuclides, oxygen with terrestrial isotope ratios, and several mineral chemical criteria. Most likely, the rock is from the iron-metal-bearing basalts of the Siberian Trap basalt sequence, which are mined for their base and platinum-group metals. Mesosiderite imposters like this may be recognized by: (1) the presence of Cu metal in hand sample or as microscopic blebs in the low-Ni metal (kamacite), (2) the absence of high-Ni metal (taenite), and (3) the presence of iron carbide (cohenite) enclosing the kamacite. Even if these macroscopic tests are inconclusive, isotopic and mineral chemical tests will also distinguish rocks like this from mesosiderites.

Author

*Basalt; Carbides; Cohenite; Cosmology; Iron Meteorites; Kamacite; Meteoritic Composition*

**20030011337** Woods Hole Oceanographic Inst., MA USA

**The Evolution of Lithospheric Deformation and Crustal Structure from Continental Margins to Oceanic Spreading Centers**

Behn, Mark D.; Jun. 2002; 246p; In English; Sponsored in part by Grant NAG5-11113 and NAG5-9143

Contract(s)/Grant(s): NAG5-3264; NAG5-4806

Report No.(s): AD-A408773; MIT/WHOI-2002-07; No Copyright; Avail: CASI; A03, Microfiche; A11, Hardcopy

This thesis investigates the evolution of lithospheric deformation and crustal structure from continental margins to mid-ocean ridges. The first part (Ch. 2) examines the style of segmentation along the U.S. East Coast Margin and investigates the relationship between incipient margin structure and segmentation at the modern Mid-Atlantic Ridge. The second part (Chs. 3-5) focuses on the mechanics of faulting in extending lithosphere. In Ch. 3, I show that the incorporation of a strain-rate softening rheology in continuum models results in localized zones of high strain rate that are not imposed a priori and develop in response to the rheology and boundary conditions. I then use this approach to quantify the effects of thermal state, crustal thickness, and crustal rheology on the predicted style of extension deformation. The mechanics of fault initiation and propagation along mid-ocean ridge segments is investigated in Ch. 4. Two modes of fault development are identified: Mode C faults that initiate near the center of a segment and Mode E faults that initiate at the segment ends. Numerical results from Ch. 5 predict that over time scales longer than a typical earthquake cycle transform faults behave as zones of significant weakness. Furthermore, these models indicate that Mode E faults formed at the inside-corner of a ridge-transform intersection will experience preferential growth relative to faults formed at the conjugate outside-corner due to their proximity to the weak transform zone. Finally, the last part of this thesis (Ch. 6) presents a new method to quantify the relationship between the seismic velocity and composition of igneous rocks. A direct relationship is derived to relate V<sub>p</sub> to major element composition and typical velocity-depth profiles are used to calculate compositional bounds for the lower continental, margin, and oceanic crust.

DTIC

*Lithosphere; Geological Faults; Deformation; Igneous Rocks*

**20030011496** Space Environment Corp., Logan, UT USA

**Development and Validation of a Global Dynamo Model and its Coupling to the CITFM Final Report**

Schunk, Robert W.; May 15, 2000; 5p; In English

Contract(s)/Grant(s): F19628-98-C-0020; AF Proj. 2688

Report No.(s): AD-A408760; AFRL-VS-TR-2002-1641; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This is a summary of the work accomplished under this effort. Develop and validate a global dynamo model and couple it to the Coupled Ionosphere and Thermosphere Forecast Models (CITFM).

DTIC

*Ionospheres; Thermosphere; Forecasting*

**20030011544** Arcon Corp., Waltham, MA USA

**Observations and Modeling of Atmospheric Radiance Structure *Final Report***

Wintersteiner, Peter P.; Nov. 2001; 54p; In English; Original contains color images

Contract(s)/Grant(s): F19628-96-C-0048; AF Proj. 2310

Report No.(s): AD-A408917; AFRL-VS-TR-2002-1586; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The overall purpose of the work that we have undertaken is to provide new capabilities for observing and modeling structured radiance in the atmosphere, particularly the non-LTE regions of the atmosphere. This purpose is well served by the work reported below. It is supplemented by the transition of some of our modeling and simulation capabilities to the Air Force, in the form of codes that we have developed and advice or assistance related to their use. Several investigations related to atmospheric radiance structure have been carried out. We used auroral data from the MSX UVISI Spectrographic Imagers in the EUV, visible, and NIR wavelengths to demonstrate the excellent spatial and temporal resolution of those instruments, and their utility for studying radiance structure. We identified small perturbations in the 4.3 micro below-the-horizon data from the MSX SPIRIT III radiometer as originating in the stratosphere, helping to confirm that the structure was produced by upwelling thunderstorm-produced gravity waves. We derived and implemented a new transfer-function algorithm in Atmospheric Radiance Code (ARC), and demonstrated its functionality. It enables rapid and repetitive non-LTE calculations to be carried out, which is essential for forward modeling of radiance structure. We participated in the development of the first non-LTE kinetic temperature retrieval algorithm, which will be useful for returning profiles above 100 km using data from the SABER instrument aboard NASA's TIMED satellite, and we used ARC for related model development and validation purposes.

DTIC

*Radiance; Atmospheric Physics; Atmospheric Models*

## 47

### METEOROLOGY AND CLIMATOLOGY

*Includes weather observation forecasting and modification*

**20030007915** Meteorological Satellite Center, Kiyose, Japan

**Monthly Report of the Meteorological Satellite Center: August 2002**

August 2002; In English; CD-ROM conforms to the ISO 9660 standard for volume and file structure; Document files and Satellite data are recorded in either ASCII or shift JIS code; Full Disk Earth's Cloud Images are recorded in Bit-Map (BMP) format; Copyright; Avail: Issuing Activity

The CD-ROM concerning the August 2002 Monthly Report of the Meteorological Satellite Center (MSC) contains the observation data derived from the Geostationary Meteorological Satellite (GMS) of Japan and the Polar Orbital Meteorological Satellites operated by NOAA. The CD-ROM contains the following observation data: Full Disk Earth's Cloud Image; Cloud Image of Japan and its vicinity; Cloud Amount; Sea Surface Temperature; Cloud Motion Wind; Water Vapor Motion Wind; Equivalent Blackbody Temperature; OLR (Out-going Longwave Radiation), Solar Radiation; Snow and Ice Index; Orbit Data; Attitude Data; VISSR Image Data Catalog (Cartridge Magnetic Tape (CMT), Micro Film); TOVS (TIROS Operational Vertical Sounder) Vertical Profile of Temperature and Precipitable Water; and TOVS Total Ozone Amount.

Derived from text

*Satellite Observation; Satellite Sounding; Atmospheric Sounding; Meteorological Parameters; Satellite Imagery; Japan*

**20030009799** NASA Langley Research Center, Hampton, VA USA

**CALIPSO: Global Aerosol and Cloud Observations from Lidar and Passive Instruments**

Poole, L. R., NASA Langley Research Center, USA; Winker, D. M., NASA Langley Research Center, USA; Pelon, J. R., Paris VI Univ., France; McCormick, M. P., Hampton Univ., USA; [2002]; 8p; In English; SPIE's 9th International Symposium on Remote Sensing, 23-27 Sep. 2002, Crete, Greece; Sponsored by International Society for Optical Engineering, Unknown; Original contains color illustrations; Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

CALIPSO (Cloud-Aerosol Lidar and Infrared Pathfinder Spaceborne Observations) is an approved satellite mission being developed through collaboration between NASA and the French space agency CNES. The mission is scheduled for launch in 2004 and will operate for 3 years as part of a five-satellite formation called the Aqua constellation. This constellation will provide a unique data set on aerosol and cloud optical and physical properties and aerosol-cloud interactions that will substantially increase our understanding of the climate system and the potential for climate change.

Author

*Aerosols; Clouds (Meteorology); Optical Radar; Cloud Physics; Satellite Observation; Space Missions*

## 48

### OCEANOGRAPHY

*Includes the physical, chemical and biological aspects of oceans and seas; ocean dynamics, and marine resources. For related information see also 43 Earth Resources and Remote Sensing.*

**20030007775** National Center for Atmospheric Research, Climate and Global Dynamics Div, Boulder, CO USA

**Nutrients, Chlorophyll, Primary Production and Related Biogeochemical Properties in the Ocean Mixed Layer. A Compilation of Data Collected at Nine JGOFS Sites**

Kleypas, J. A.; Doney, S. C.; Apr. 2001; 70p; In English

Report No.(s): PB2003-101392; NCAR/TN-447-STR; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Global carbon cycle models are becoming more prevalent and sophisticated as the scientific community seeks to understand how various earth systems will respond to increasing CO<sub>2</sub> in the atmosphere. The role of the biosphere, particularly in the marine environment, is gaining more attention as physical and biological modelers alike realize that the ocean's role in the carbon cycle may be largely influenced by biogeochemical reactions in the upper ocean. The fixing of inorganic carbon by phytoplankton in the euphotic zone (production), largely depends on physical processes to deliver limiting macronutrients from deeper oceanic zones. The ultimate fate of that production is in turn controlled by physics (advection, mixing), and by biological processes such as how various food webs package the carbon into sinking particles or dissolved organic matter (DOM), how much is recycled in the euphotic zones, and how much is exported as sinking material or DOM. Net community export production is a measure of how much fixed carbon is removed from the surface ocean. These values are difficult to obtain on a global or even regional basis, and vary widely from studies based on satellite data, empirical and theoretical temperature relationships and ecosystem models. Bringing these various approaches toward a more complete understanding of upper ocean carbon cycle science has been a standing goal of the U.S. JGOFS Synthesis and Modeling Project (U.S. JGOFS 1997). This technical report is an effort to provide investigators with physical, biological, and chemical data in a common format for various sites around the globe. This technical report provides summary data for nine distinct US JGOFS and international JGOFS sites. Four of these are point-locations where long-term time-series data have been collected: the Bermuda Atlantic Time-series Study (BATS); the Hawaiian Ocean Time-series (HOT); KERFIX, the French JGOFS site; and Station P, the Canadian JGOFS time-series station. The remaining sites are U.S. JGOFS Process Study sites: Arabian Sea; Equatorial Pacific (EqPac); North Atlantic Bloom Experiment (NABE); and the Antarctic Environment and Southern Ocean Survey (AESOPS) (which includes two distinct regions: the Ross Sea and Antarctic Polar Front Zone). to provide an easy to use, practical presentation of data from each of these sites, both depth-profile data and the mixed layer average for each variable are determined on a cast-by-cast basis.

NTIS

*Surveys; Oceans; Marine Environments; Oceanography; Chlorophylls; Caloric Requirements; Rhythm (Biology)*

**20030007797** National Ocean Service, Office of National Marine Sanctuaries, Silver Spring, MD USA

**State of Coral Reef Ecosystems of the USA and Pacific Freely Associated States: 2002**

Jul. 2002; 290p

Report No.(s): PB2003-101065; No Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche

The USA has jurisdiction over majestic coral reefs covering an estimated 7,607 sq mi in the tropical-subtropical belt around the equator. Many of these reef systems support diverse, brightly colored marine life surrounded by emerald seas, others have been affected by environmental and human-related impacts and need restoration. This report assesses the condition of reef resources, ranks the relative importance of environmental pressures that have degraded reefs, highlights significant actions taken by the USA Coral Reef Task Force (USCRETF) agencies to conserve reef ecosystems, and provides recommendations to fill information gaps. It forms a baseline against which future assessments will be compared, allowing scientists to track and ultimately predict changes in reef conditions.

NTIS

*Coral Reefs; Ecosystems; Environmental Control; Environmental Monitoring; Conservation*

**20030011485** Army Engineer Research and Development Center, Coastal and Hydraulics Lab., Vicksburg, MS USA

**Eastcoast 2001, A Tidal Constituent Database for Western North Atlantic, Gulf of Mexico, and Caribbean Sea *Final Report***

Mukai, A. Y.; Westerink, J. J.; Luetlich, R. A., Jr.; Mark, D.; Sep. 2002; 196p; In English; Original contains color images  
Report No.(s): AD-A408733; ERDC/CHL-TR-02-24; No Copyright; Avail: CASI; A09, Hardcopy; A03, Microfiche

This report describes the development of the Eastcoast 2001 database of computed tidal elevation and velocity constituents within the Western North Atlantic Tidal (WNAT) domain. The WNAT domain encompasses the Western North Atlantic Ocean, Gulf of Mexico, and Caribbean Sea. The computations are based on a strategically designed finite element grid and the coastal hydrodynamic circulation model, ADCIRC. The resulting Eastcoast 2001 database defines the computed elevation and velocity amplitude and phase for the O1, K1, Q1, M2, S2, N2, and K2 tidal constituents. The Eastcoast 2001 database is significantly more accurate than the previous Eastcoast 1995 and Eastcoast 1991 databases based on the following feature improvements: (a) a new grid generation technique with better node placement and distribution; (b) a significantly greater number of total nodes; (c) a more accurate coastal boundary; (d) inclusion of more reliable bathymetric databases. The new grid generation technique is the combination of two a priori mesh criteria: (a) The wavelength to grid size ratio; (b) the topographic length scale criteria. This combination optimally and more accurately places grid nodes in areas where high resolution is needed. Error analysis of computed versus measured elevation amplitude and phase at 101 stations in addition to an assessment of measured data errors globally and locally quantifies the level of reliability of the computed constituents.

DTIC

*Data Bases; Ocean Dynamics; Computerized Simulation*

**20030011506** Michigan Univ., Div. of Research, Ann Arbor, MI USA

**HF Radar Measurements of Ocean Surface Currents and Winds**

Vesecky, John F.; Nov. 18, 2002; 6p; In English

Contract(s)/Grant(s): N0014-99-1-0174

Report No.(s): AD-A408586; EDI/EFT-7129AC; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The objectives of this project began with the construction and deployment of two and later three multifrequency HF radar instruments (called MCR for Multifrequency Coastal Radar) to Monterey Bay, California. Further experiment deployments were to the Virginia coast and to Lake Michigan for fresh water experiments (NSF sponsorship). The data collected at these sites is reduced, analyzed and interpreted to achieve the specific research objectives listed below: 1. Improvement of radar performance by upgrading hardware and software and developing improved transmit antennas, signal processing and flexible use of multiple frequencies 2. Improvement of HF radar estimates of surface currents, vertical shear, winds, friction velocity and waves by improved estimation algorithms that use knowledge of air-sea interaction physics 3. Estimate surface wind speed and direction using multifrequency HF radar measurements by exploiting air-sea interaction physics and HF radar measurements of vertical current shear 4. Ocean science investigations, including assimilation of HF radar data into coastal ocean models for circulation, chemical and biological properties as well as air-sea interaction studies 5. Use of continuing HF radar observations on Monterey Bay in observing ships to assess the usefulness of multiple frequency HF radar in ship detection and tracking.

DTIC

*Measurement; High Frequencies; Ocean Currents; Ocean Surface; Radar; Ocean Models*



51  
**LIFE SCIENCES (GENERAL)**

*Includes general research topics related to plant and animal biology (non-human); ecology; microbiology; and also the origin, development, structure, and maintenance, of animals and plants in space and related environmental conditions. For specific topics in life sciences see categories 52 through 55.*

**20030007690** Palo Alto Inst. for Research and Education, Inc., Palo Alto, CA USA

**Negative Regulation of Tumor Suppressor p53 Transcription in Breast Cancer Cells** *Annual Report, 1 Jul. 2001-30 Jun. 2002*

Liu, Jingwen; Jul. 2002; 66p; In English

Contract(s)/Grant(s): DAMD17-00-1-0394

Report No.(s): AD-A408185; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Recently, there is emerging information to link STAT3 signaling pathway with tumor suppressor p53. Our previous studies have demonstrated that the transcription of the p53 gene in breast cancer cells was down regulated by cytokine oncostatin M (OM). The second goal of our proposal was to evaluate the critical role of STAT3 in OM-mediated regulation of p53 transcription. In this report, we show that blocking STAT3 transactivating activity by the expression of a dominant negative mutant of STAT3 (dnStat3) reversed the OM inhibitory effects on p53 promoter activity and p53 protein expression, demonstrating an involvement of STAT3 in OM-mediated negative regulation of the p53 transcription. In addition, to determine functional roles p53 in the process of proliferation and differentiation of breast cancer cells, we generated stable cell lines (MCF-7 ptsp53) that express p53Val135 temperature-sensitive mutant. When cultured at 37 deg C, p53Val135 transfectants expressed exogenous p53 in a mutant conformation that acted as a dominant negative mutant and inhibited the transactivation of endogenous p53. In contrast, at permissive temperature 32 deg C, the p53Val135 mutant resumed normal conformation and behaved as the wild-type p53. We found that overexpression of functional p53 in MCF-7 cells leads to growth arrest at the G2/M phase of the cell cycle without an induction of apoptosis.

DTIC

*Cells (Biology); Mammary Glands; Cancer; Transcription (Genetics)*

**20030007692** Maryland Univ., Baltimore, MD USA

**The Regulatory Interactions of p21 and PCNA in Human Breast Cancer** *Annual Report, 1 Jul. 1999-30 Jun. 2002*

Hoelz, Derek; Malkas, Linda; Jul. 2002; 88p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-99-1-9273

Report No.(s): AD-A408176; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Proliferating cell nuclear antigen (PCNA) is a multifunctional enzyme involved in multiple cellular processes including DNA replication and repair. During DNA replication, PCNA function as an accessory factor- for the DNA polymerases E and are part of a multiprotein DNA replication complex termed the DNA synthesome. Isolation and analysis of the of the DNA synthesomes from non-malignant and malignant breast cells has previously shown that replication fidelity is significantly reduced in malignant cells as compared to non-malignant cells. This reduction in replication fidelity in malignant cells is accompanied by a structural alteration to PCNA. In attempts to explain how this structural alteration to PCNA present in malignant cells could result in lowered replication fidelity, the ability PCNA present in malignant cells to interact with p21WAF1 was examined. Initially identified as a cyclin-dependent kinase inhibitor, p21WAF1 ability to inhibit DNA replication in response to DNA damage has been well characterized. Interestingly, p21WAF1 inhibits DNA replication by interacting with PCNA, and an inability of p21WAF1 to interact with the structurally altered PCNA present in malignant cells could have tremendous mutagenic potential. However, research soon proved that the effects of this structural change to PCNA would not be so simple. Examination of the interaction of p21WAF1 with PCNA revealed a third form of PCNA present in malignant cells that preferentially bound p21WAF1. Elucidation of three isoforms of PCNA present in malignant breast cells may therefore represent signaling events that link DNA replication to DNA repair through structural alterations to PCNA.

DTIC

*Deoxyribonucleic Acid; Mammary Glands; Cancer; Antigens*

**20030007696** Baylor Coll. of Medicine, Houston, TX USA

**Research Training Program in Breast Cancer** *Annual Report, 1 Jul. 2001-30 Jun. 2002*

Medina, Daniel; Jul. 2002; 24p; In English

Contract(s)/Grant(s): DAMD17-99-1-9073

Report No.(s): AD-A408170; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The goal of this research training program is to produce highly qualified scientists for careers as independent investigators in the field of breast cancer. During the last 25 years, there has been a fundamental revolution in the understanding of molecular and cell biological concepts related to cell growth, function and tumorigenesis. To utilize what has been learned and to continue future progress in the area of breast cancer requires the continued availability of well-trained, innovative and committed scientists. This program represents an interdepartmental training program involving 15 investigators from seven departments. Trainees are predoctoral and postdoctoral fellows with backgrounds in biochemistry, cell and molecular biology, molecular genetics and molecular virology. The training program provided trainees with additional foundation in carcinogenesis and breast cancer.

DTIC

*Research Management; Mammary Glands; Cancer; Education*

**20030007699** Harvard Medical School, Boston, MA USA

**Kinase Independent Functions of Cyclin D1 Which Contribute to its Oncogenic Potential In Vivo Annual Report**

Landis, Mark W.; Hinds, Philip W.; Jul. 2002; 12p; In English

Contract(s)/Grant(s): DAMD17-00-1-0279

Report No.(s): AD-A408164; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Cyclin D1, an important cell cycle regulator, is a potent oncogene in several tumor types, including breast cancer. The most well understood function of cyclin D1 is to bind and activate cdks 4 and 6. One target of these kinases is pRb. Upon phosphorylation, pRb is inactivated, and cells pass from G1 into S phase. We and others have demonstrated that cyclin D1 has other functions, many of which are independent of kinase activity in vivo. In vivo demonstration of kinase independent functions of cyclin D1 may help elucidate the underlying mechanisms of cyclin D1 oncogenicity. To determine whether cyclin D1 has important kinase-independent functions in vivo, we are generating a cyclin D1 K112E knock-in mouse.

DTIC

*Enzymes; Cancer; Mammary Glands; Oncogenes*

**20030007718** Evanston Northwestern Healthcare Research Inst., Evanston, IL USA

**Caspase Deficiency: Involvement in Breast Cancer Carcinogenesis and Resistance Annual Report, 1 Jul. 2001-30 Jun. 2002**

Yang, XiaoHe; Jul. 2002; 31p; In English

Contract(s)/Grant(s): DAMD17-99-1-9180

Report No.(s): AD-A408160; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This project was proposed to study the correlation between caspase deficiency and breast cancer carcinogenesis and therapeutic resistance. During the third year, we continued to perform the functional screening of breast cancer cell lines treated with TNF-alpha and correlate their response with expression status of caspases in the cell lines detected in specific aim 1. Among the 7 breast cancer cell lines detected this year, BT-483, MDA-NB-134VI and MDA-MB-415 cells, which expressed lower levels of caspase 8, were resistant to TNF-alpha. When 19 breast cancer cell lines were treated with granzyme B, correlation between granzyme B induced apoptosis and caspase levels was less obvious as compared to TNF-alpha treatment. We have also analyzed sensitivity of 17 breast cancer cell lines treated with radiation and calculated the corresponding ID50 of each cell line.

DTIC

*Cancer; Mammary Glands; Enzymes; Resistance*

**20030007720** Alabama Univ., Birmingham, AL USA

**Internet Support and Information for Women with Breast Cancer Annual Report, 1 Jul. 2001-30 Jun. 2002**

Owen, Jason E.; Tucker, Diane C.; Jul. 2002; 44p; In English

Contract(s)/Grant(s): DAMD17-00-1-0121

Report No.(s): AD-A408155; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Traditional methods of providing psychosocial interventions for cancer patients are associated with positive patient outcomes but have limited overall impact attributable to low participation rates. The purpose of this project is to implement and evaluate the efficacy of a computer-based psychosocial intervention for women with breast cancer. At the end of the second year of funding, we have continued to implement the SURVIVE intervention, and results from the second year are summarized in this annual report. 243 women have been screened in the UAB breast cancer clinics, and of these 243 women, 109 (45%) have agreed to participate. At the time this analysis was conducted, 69 of these 109 patients had been enrolled and randomized into the trial.

DTIC

*Psychological Factors; Social Factors; Mammary Glands; Cancer*

**20030007724** Chicago Univ., Chicago, IL USA

**Comparative Structural Analysis of Er-alpha and Er-beta Bound to Selective Estrogen Agonists and Antagonists *Final Report, 14 Jun. 1999-13 Jun 2002***

Greene, Geoffrey L.; Jul. 2002; 30p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-99-1-9120

Report No.(s): AD-A408189; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The goal of this investigation is to determine the three-dimensional structures of the two known human estrogen receptors (ER-alpha and ER-beta) complexed with receptor-selective estrogens and antiestrogens (SERMs). The crystallographic structures of ER-alpha and ER-beta ligand binding domains complexed with cis-R,R-diethyl-tetrahydrochrysene-2,8-diol (R,R-THC) have been solved and refined, suggesting mechanisms by which this compound can act as an ER-alpha agonist and as an ER-beta antagonist. Agonists and antagonists bind at the same site within the core of the ER LBD to induce distinct conformations in the transactivation domain (AF-2), especially in the positioning of helix 12. Previously determined structures of ER-alpha with 4-hydroxytamoxifen (OHT) and diethylstilbestrol (DES) revealed and defined a multipurpose docking site on ER-alpha and ER-beta that can accommodate either helix 12, in the presence of OHT, or one of several co-regulators in the presence of DES. R,R-THC stabilizes a conformation of the ER-alpha LED that favors coactivator association and a conformation of the ER-alpha LBD that prevents coactivator association. A comparison of the two structures, combined with functional data, reveals that THC does not act on ER-beta through the same mechanisms used by other known ER antagonists. Instead, THC antagonizes ER-beta through a novel mechanism we term "passive antagonism". Paradoxically, the R,R-THC-ER-beta structure is very similar to the structure induced by genistein, which acts as a partial estrogen through both ER subtypes. Ongoing mutagenesis studies have helped define some of the molecular and structural differences that are responsible for these unanticipated results. The passive antagonism mechanism, combined with mutagenesis data, suggests a novel approach to the design of ligands that selectively antagonize the two ER subtypes. Such ligands may have therapeutic properties that can be exploited to prevent or treat breast cancer.

DTIC

*Hormones; Estrogens; Mammary Glands; Cancer; Ligands*

**20030007777** National Inst. on Aging, Bethesda, MD USA

**Aging Under the Microscope: A Biological Quest**

Sep. 2002; 60p; In English

Report No.(s): PB2003-100827; NIH/PUB-02-2756; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Contents include the following: Posing Questions, Finding Answers; The Genetic Connection (Longevity Genes, Cellular Senescence, Proliferative Genes, Telomeres); Biochemistry and Aging (Oxygen Radicals, Protein Crosslinking, DNA Repair and Synthesis, Heat Shock Proteins, Hormones, Hormone Replacement, Growth Factors); Physiologic Clues (Normal Aging, The Immune System, Caloric Restriction, Behavior Factors); The Future of Aging (Stem Cells: Great Expectations); Glossary/Bibliography (Glossary, Bibliography).

NTIS

*Genetics; Cells (Biology); Human Body; Aging (Biology)*

**20030010455** California Univ., Lawrence Berkeley Lab., Berkeley, CA USA

**MAPK - A Critical Intermediate in Anti-Estrogen Resistance *Final Report, 1 Sep. 1998-31 Aug. 2002***

Lupu, Ruth; Sep. 2002; 9p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-98-1-8289

Report No.(s): AD-A408666; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

In the last decade, numerous studies have indicated that polypeptide growth factors and their receptors play an important role in breast cancer and have mitogenic effects. One such family constitutes the heregulins (ERGs), EGF-like growth factors that bind directly to the erbB3 and erbB4 receptors and induce tyrosine phosphorylation of erbB2 via receptor heterodimerization. Previous studies from our laboratory, have demonstrated that HRG-beta2 induces estrogen-independent growth, estrogen receptor down-regulation, enhances cell proliferation, tumorigenicity and metastasis when stably transfected into estrogen receptor positive MCF-7 breast cancer cells. Some evidence suggests a role for the Ras-Raf-MAPK pathway in HRG signaling. HRG induces tyrosine phosphorylation of SHC and its association with GRB2-SOS complex, which in turn can activate p21ras. It also activates a down stream target of ras, p42/44 MAPK. The Ras-Raf-MAPK pathway is required for proliferative response to many growth factors and hormones. A cross talk has also been established between MAPK and estrogen receptor (ER), since MAPK can activate ER independent of estrogen by stimulating its phosphorylation at Ser 118. In this study, we have used a GDP-bound

dominant negative mutant of ras (N17) in order to determine the involvement of Ras/-Raf-MAPK pathway in acquisition of HRG-induced estrogen-independent phenotype.

DTIC

*Estrogens; Mammary Glands; Cancer; Receptors (Physiology); Cells (Biology)*

**20030010458** Maryland Univ., Baltimore, MD USA

**Mechanistic Basis for Use of Aldose Reductase Inhibitors to Treat Breast Cancer** *Final Report, 1 Aug. 2001-31 Jul. 2002*

Shapiro, Paul S.; Aug. 2002; 36p; In English

Contract(s)/Grant(s): DAMD17-01-1-0548

Report No.(s): AD-A408682; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Changes in glucose metabolism during diabetes are linked to an increased risk for the development of breast cancer. Aldose reductase, the rate-limiting polyol pathway enzyme that converts glucose into sorbitol, not only is an important mediator of the pathologies associated with diabetes, but is also upregulated in many cancer cells and may be involved in cancer cell resistance to chemotherapeutic drugs. Furthermore, increased expression of aldose reductase in cancer cells may reduce the effectiveness of chemotherapeutic compounds by increasing drug metabolism or by decreasing drug uptake. Thus, these studies addressed the hypothesis that inhibition of aldose reductase enhances cell sensitivity to anti-cancer drugs. Using the specific aldose reductase inhibitor, ethyl 1-benzyl-3-hydroxy-2(5H)-oxopyrrole-4-carboxylate (EBPC), experiments tested whether aldose reductase inhibition could enhance the cytotoxic effects of the anti-cancer agents doxorubicin or cisplatin in Hela cervical carcinoma and MDA-MB-468 breast cancer cells. Cell growth and death assays revealed that co-administration of aldose reductase inhibitors increased the cytotoxic effects of chemotherapeutic drugs on cervical and breast cancer cells. In summary, these data provide evidence to support further studies testing the use of aldose reductase inhibitors as adjuvant therapy to improve the effectiveness of existing chemotherapeutic drugs.

DTIC

*Cancer; Mammary Glands; Pathology; Chemotherapy; Metabolic Diseases; Inhibitors*

**20030010459** Mayo Foundation, Rochester, MN USA

**Ultrasonic Stimulated Acoustic Emission for Detection of Breast Microcalcifications** *Final Report, 15 Apr. 1998-14 Apr 2002*

Fatemi, Mostafa; May 2002; 98p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-98-1-8121

Report No.(s): AD-A408683; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

The purpose of this research is to develop an experimental imaging system based on Ultrasound Stimulated Acoustic Emission (USAE) for detecting microcalcifications in human breast tissue specimens. The scope of this research is to develop the theory, improve the experimental USAE system, and perform USAE imaging on human breast tissue samples. The first task of this research is focused on system development and optimization for detection of breast microcalcifications. The second task is centered on imaging breast tissues using USAE method for detection of microcalcifications. This report covers the entire project period including the results of Tasks 1 and 2. Results show that USAE can detect microcalcifications and calcified vessels. Results are verified using x-ray mammography. In addition to detection of microcalcifications, it is shown that USAE has may be used to determine the mechanical properties of the medium surrounding a small inclusion.

DTIC

*Acoustic Emission; Detection; Mammary Glands; Stimulated Emission; Ultrasonics; Calcification; Cancer*

**20030010461** Baylor Coll. of Medicine, Houston, TX USA

**Molecular Basis of the Response to Radiation** *Final Report, 26 May 2001-25 May 2002*

Plon, Sharon E.; Jun. 2002; 59p; In English

Contract(s)/Grant(s): DAMD17-98-1-8281

Report No.(s): AD-A408686; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This three year IDEA Award with a one year no cost extension has been completed. We have made progress towards all three Technical Objectives. We encountered scientific problems isolating novel cDNAs encoding human homologs of yeast DNA damage response genes RAD9 and DUN1 during year 1 and year 2. In contrast, two hybrid screens resulted in the isolation of human homologs of RAD18 and RAD21 and the focus over years 2, 3 and 4 has been the characterization of the human RAD21 protein in mammalian cells and it's degradation in response to DNA damage. Alterations in expression of human RAD21 mRNA and protein in human breast cancer cell lines were detected. We also demonstrated that RAD21 is cleaved upon induction of the apoptotic pathway (as opposed to DNA damage itself). The cleavage site has been biochemically identified, characteristics of the



cleavage enzyme determined and cellular localization of the cleaved proteins performed. The carboxy terminal RAD21 cleavage product has a pro-apoptotic effect on murine mammary cells generating a positive feedback loop in apoptosis. A manuscript describing this regulation of the mammalian RAD21 protein has been submitted and is currently under review.

DTIC

*Radiation; Molecular Biology; Deoxyribonucleic Acid; Apoptosis; Cells (Biology)*

**20030010462** Baylor Coll. of Medicine, Houston, TX USA

**Mouse Mammary Cancer Models - Mechanisms and Markers** *Annual Report, 1 Aug. 1999-31 Jul. 2002*

Donehower, Lawrence A.; Aug. 2002; 23p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-99-1-9069

Report No.(s): AD-A408687; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We have generated and characterized several mouse models to better understand the role of breast cancer associated genes in an experimentally manipulable context. We have focused on the role of p53 and p53 target genes and their role in promoting mammary cancer. Recent emphasis has been placed on the Wild type p53-Induced Phosphatase (Wip1), also known as Ppm1D. This gene has recently been demonstrated to be an oncogene in vitro and to be specifically amplified in more than 15% of human breast cancers. to study the role of Wip1 in mammalian development, physiology, and cell cycle control, we generated knockout mice that are deficient in Wip1. Wip1-deficient mice exhibit multiple developmental defects and their cells show defects in cell cycle progression. We have confirmed that Wip1 is radiation-induced p53 target gene and we have identified three novel potential Wip1 interacting proteins.

DTIC

*Oncogenes; Mammary Glands; Biomarkers; Embryology; Mammals*

**20030010463** Johns Hopkins Univ., School of Medicine, Baltimore, MD USA

**Prediction of Pathologic Fracture Risk in Activities of Daily Living and Rehabilitation of Patients With Metastatic Breast Carcinoma of the Pelvis and Femur** *Final Report, 15 Jul. 1999-14 Jul 2002*

Inoue, Nozomu; Aug. 2002; 45p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-99-1-9239

Report No.(s): AD-A408690; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The purpose of the project was to develop a computer model of the pelvis and proximal femur which could be used to predict pathologic fracture risk and study the effects of pelvic and proximal femoral metastatic bone lesions on the care and management of breast cancer patients. The scope of the research was to construct graphical and quantitative models of the pelvis and proximal femur on a computer workstations including Finite Element Method and Discrete Element Method to study the stress and strain in the pelvis and proximal femur and pressure distribution of the hip joint in the patient with metastatic bone lesions of the breast cancer in the pelvis and proximal femur with interactive capability. This project resulted in the development of a computer model of the hip joint which can be used to predict the pathologic fracture risk and study the effects of metastatic bone lesions on the hip joint. The computer model is user-friendly and interactive, and the critical areas for pathologic fracture during various activities can be demonstrated in three-dimensional graphics and animations. This computer model will aid in planning of non-operative or operative management, rehabilitation regimens, nursing programs, and patient education.

DTIC

*Bones; Mammary Glands; Cancer; Metastasis*

**20030010465** Johns Hopkins Univ., Baltimore, MD USA

**Molecular Epidemiology of Breast Cancer in Korean Women** *Annual Report, 15 Jul. 2001-14 Jul 2001*

Gabrielson, Edward W.; Aug. 2002; 5p; In English

Contract(s)/Grant(s): DAMD17-01-1-0283

Report No.(s): AD-A408692; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

This project is testing the hypothesis that breast cancer in elderly women represents a disease different than breast cancer in young women. The hypothesis is being tested using gene expression profiles as objective measures of breast cancer phenotypes. The study is being conducted using samples from Korean women because this likely represents a relatively homogeneous population from genetic and cultural perspectives. The proposed first phase of the project is to identify genes that are differentially expressed in a small set of breast cancers from young and elderly women. While we have been technically successful in conducting these studies as proposed, we have not found consistent differences in gene expression patterns between cancers from young and elderly patients. The second phase of this project is to construct a custom array that represents candidate genes for differentiating the cancers from young and elderly women. We will begin constructing this array soon, using genes that are differentially

expressed among different breast cancers Subsequent experiments will measure gene expression profiles in additional samples of breast cancers from Korean women and ultimately North American women.

DTIC

*Mammary Glands; Cancer; Epidemiology; Investigation*

**20030010468** Vanderbilt Univ., Nashville, TN USA

**Genetic Analysis of a Mammalian Chromosomal Origin of Replication** *Annual Report, 1 Aug. 1999-31 Jul. 2002*

Altman, Amy L.; Aug. 2002; 37p; In English

Contract(s)/Grant(s): DAMD17-99-1-9420

Report No.(s): AD-A408698; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The purpose of this study was to begin to understand the mechanism of replication initiation in mammalian cells in order to gain insight into how misregulation of initiation may lead to cancer progression. We have shown that a 5.8 kb DNA fragment containing the initiation region (IR) DHFR ori-beta is active at ectopic chromosomal locations in hamster cells and that deletion of three specific elements in ori-beta reduced initiation activity. Further characterization of these elements showed that an AT-rich element is required for efficient ori-beta activity, and that a homologous region of the human lamin B2 origin can substitute for this element. In addition, the 5.8 kb ori-beta DNA fragment is sufficient to direct replication initiation in two human cancer cell lines, suggesting a possible conservation of the mechanisms of replication initiation in mammalian cells. In order to begin to understand the relationship of origin activity and initiator protein binding, we assessed protein binding to ectopic ori-beta in a human cancer cell line. We found that initiation proteins localized to the replication start site of ori-beta and deletion of the AT-rich element modulated protein binding. Taken together, these results suggest a potential relationship between ORC binding and origin selection and activation.

DTIC

*Chromosomes; Genetics; Growth; Mammary Glands; Cancer*

**20030010469** California Univ., Los Angeles, CA USA

**The Role of Myoepithelial Maspin in Breast Carcinoma Progression, Diagnosis and Screening** *Annual Report, 3 Jul. 2001-2 Jul 2002*

Barsky, Sanford H.; Aug. 2002; 50p; In English

Contract(s)/Grant(s): DAMD17-00-1-0176

Report No.(s): AD-A408699; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In glandular organs a precancerous state precedes invasive carcinoma. in the breast this state is recognized as DGIS and consists of an epithelial cell proliferation confined by myoepithelial cells. Our laboratory has established cell lines/xenografts of myoepithelial cells. Our myoepithelial cell lines inhibit invasion and motility of breast carcinoma lines in vitro largely through maspin. The overall hypothesis of this proposal was how does myoepithelial maspin regulate breast (DCIS) carcinoma progression and can its detection in fine needle aspirates (FNA) and in ductal fluid abet diagnosis and screening? The first aim addressed the mechanism of maspin's inhibition of breast carcinoma invasion: We have shown that myoepithelial maspin does bind to plasma membranes of carcinoma cells and inhibit a pathway involved in cellular locomotion. Using differential display and microarray analysis we have further characterized the pathway(s) involved. The second aim utilized maspin antibodies on FNA to identify the myoepithelial component and we have further demonstrated with larger number of samples that this approach is successful. The third aim investigated the levels of maspin in nipple aspirates, in ductal lavage fluid and saliva. We have shown that maspin is both a tumor marker as well as a surrogate intermediate end point marker Studies were conducted in year 02 that further extended our findings.

DTIC

*Epithelium; Diagnosis; Organs; Mammary Glands; Cancer; Screening*

**20030010470** George Washington Univ., Washington, DC USA

**Physiological Stress-Induced Drug Resistance and Its Reversal** *Annual Report, 1 Jul. 2001-30 Jun. 2002*

Kennedy, Katherine A.; Jul. 2002; 63p; In English

Contract(s)/Grant(s): DAMD17-99-1-9186

Report No.(s): AD-A408700; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Physiological stress conditions associated with solid tumor play a role in chemotherapeutic resistance. Treatment with hypoxia or chemical stress agents causes EMT6 mouse mammary tumor cells to develop resistance to etoposide and teniposide, prototypic topoisomerase II inhibitors. We have shown that NFkB activation plays an important role in stress induced resistance and have used gene expression technology to identify potential genes responsible for the resistant phenotype. One pathway

identified involves TGF-beta, PDGFRalpha and MEK1/2 which we have shown to be directly linked to NFkB activation in EMT6 mouse mammary tumor cells. Further additional potential genes involved in the reversal of resistance have been identified. Our data suggest that interrupting the NFkB pathway may be a useful strategy to improve the efficacy of topoisomerase II inhibitors.

DTIC

*Stress (Physiology); Drugs; Resistance*

**20030010471** University of South Florida, Tampa, FL USA

**Optimization of CAD System Using Adaptive Simulated Annealing for Digital Mammography** *Annual Report, 1 Jul. 2001-30 Jun. 2002*

Sun, Xuejun; Qian, Wei; Jul. 2002; 8p; In English

Contract(s)/Grant(s): DAMD17-01-10396

Report No.(s): AD-A408701; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Mammography plays an important role in the detection and diagnosis of breast cancer. Although computer-aided detection (CAD) scheme is essential and acts as second opinion for the detection and diagnosis of breast cancer, its performance for SFM is not suitable for clinical trial due to the lack of full optimization for CAD system. In addition, current CAD system is not evaluated on FFDM images. The purpose of this study is to develop a new kind of fully optimized CAD system for PFDM using a global optimization algorithm to improve its performance on sensitivity and specificity in mass and MCCs detection on mammograms. In the initial grant year, the major accomplishments are as follows: (1) Databases for training and testing of CAD system performance have been constructed and corresponding truth files have been generated for FFDM and SFM respectively. (2) Performance of current CAD system for the detection and diagnosis of breast cancer has been retrospectively evaluated on FFDM and SFM images, respectively. (3) CAD modules have been developed or modified for FFDM.

DTIC

*Diagnosis; Cancer; Mammary Glands; Imagery; Medical Equipment*

**20030010472** California Univ., Lawrence Berkeley Lab., Berkeley, CA USA

**Extracellular Matrix-Induced Chromatin Modifications in Normal and Malignant Human Breast Cells** *Annual Report, 1 Jul. 2000-30 Jun. 2002*

Beyec, Johanne L.; Jul. 2002; 21p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-00-1-0225

Report No.(s): AD-A408704; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Human mammary epithelial S1 cells cultured in a 3D reconstituted basement membrane (rBM) growth arrest and form polarized acini-like structures. This differentiation in 3D rBM is accompanied by rearrangements of the nuclear architecture. ECM itself influences gene expression and cellular function by diverse mechanisms including ligand-receptor interaction, promotion of cell-cell adhesion, and modulation of cell shape. The changes in gene expression that occur during differentiation or tumorigenesis are accompanied by characteristic patterns of chromatin reorganization, modulated, in part, through highly regulated, histone acetylation/deacetylation mechanisms. We found that the differentiation of S1 cells into acini is accompanied by deacetylation of histone H4. Here we tried to elucidate the mechanisms by which the cellular microenvironment signals to nuclear acetylation/deacetylation events in the S1 cells. The rBM induced histone H4 deacetylation is neither directly related to growth nor to the ECM-induced signaling. We assessed the role of cell shape on histone H4 acetylation. Cells cultured on the non-adhesive substratum polyHEMA round up and form multicellular aggregates. In this context, they also display a significant deacetylation of histone H4. Using cytochalasin D to disturb the actin filaments, we are now analysing the role of actin organization in this process.

DTIC

*Epithelium; Cells (Biology); Growth; Cancer; Mammary Glands*

**20030010473** Tulane Univ., Office of Research, New Orleans, LA USA

**Melatonin, Aging and Breast Cancer** *Annual Report, 1 Jun. 2001-31 May 2002*

Hill, Steven M.; Jun. 2002; 12p; In English

Contract(s)/Grant(s): DAMD17-00-1-0473

Report No.(s): AD-A408705; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We have developed data demonstrating that the pineal gland, via its hormone melatonin, inhibits the proliferation of both human and animal models of breast cancer. As humans age there is the onset of disrupted sleep leading to a significant suppression in the nocturnal levels of melatonin after age 60. Based on these data we have hypothesized that the decline in pineal melatonin production, with the onset of old age, is a key factor in the age related increase in breast cancer. Using the Buffalo rat as a model,

we have begun to characterize the melatonin rhythm in young, middle aged and old female rats. Our studies demonstrate that the nocturnal rise in both serum and pineal melatonin is significantly blunted in old rats compared to middle aged and young rats, and is blunted in middle aged rats compared to young rats. As well, uterine mtl melatonin receptor levels are greatly diminished in old female rats (by 80%) compared to young female rats. Finally, in our preliminary studies, tissue-isolated NMU-induced mammary tumors grew faster in young rats as compared to middle aged rats. However, tumors in middle aged rats are less responsive to the growth-suppressive actions of melatonin.

DTIC

*Hormones; Aging (Biology); Mammary Glands; Cancer*

**20030010476** Baylor Coll. of Medicine, Houston, TX USA

**The Effect of Recombinant Factor VIIa and Fibrinogen on Bleeding from Grade V Liver Injuries in Coagulopathic Swine**  
**Annual Report, 1 Sep. 2001-31 Aug. 2002**

Schreiber, Martin A.; Holcomb, John B.; Brundage, Susan I.; Macaitis, Joe M.; Tweardy, David J.; Sep. 2002; 18p; In English  
 Contract(s)/Grant(s): DAMD17-01-1-0693

Report No.(s): AD-A408711; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Recombinant factor VIIa (rFVIIa) has been used to decrease bleeding in a number of settings including hemophilia, liver transplantation, intractable bleeding and cirrhosis. This study was performed to determine if rFVIIa would reduce bleeding after a grade V liver injury in hypothermic, dilutionally coagulopathic pigs when used as an adjunct to abdominal packing and to determine the optimal dose of the drug. Methods: Thirty animals were randomized to receive 180 mug/kg of rFVIIa, 720 mug/kg of rFVIIa or control. After laparotomy and splenectomy animals underwent a 60% of blood volume isovolemic exchange transfusion with 5% human albumin. The animals' temperature was maintained at 33°C and a grade V liver injury was made with a clamp. Thirty seconds after injury the abdomen was packed with laparotomy sponges, resuscitation was initiated and blinded therapy was given. Animals were resuscitated to their baseline mean arterial pressure (MAP) and the study was continued for 2 hours. Serial coagulation parameters were measured at the temperature they were drawn. Following the study period, surviving animals were euthanized, post-treatment blood loss was measured and an autopsy was performed. Results: Ten animals were randomized to each group. Following administration of study drug, the mean prothrombin time (PT) was shorter in the treatment groups than in the control group. MAP was lower in the control group than the treatment groups throughout the study, ( $p < 0.01$ ). Mean blood loss was significantly less in the treatment groups than the control group. Mortality was not different between groups. There were no differences between the groups that received rFVIIa in any measured parameters. Conclusions: rFVIIa reduces blood loss in hypothermic, dilutionally coagulopathic pigs with grade V injuries when used as an adjunct to packing. Increasing the dose does not enhance the hemostatic effect.

DTIC

*Drugs; Hemorrhages*

**20030010478** Army Research Inst. of Environmental Medicine, Military Performance Div., Natick, MA USA

**The Effect of Walking Speed and Adding a Backpack on Trunk Dynamics During Treadmill Walking**

LaFiandra, Michael; Wagenaar, Robert; Holt, Kenneth; Obusek, John P.; Oct. 2002; 40p; In English

Report No.(s): AD-A408713; USARIEM-TR-T03-3; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

To determine the effects of load carriage and walking speed on stride parameters and the coordination of trunk movements, twelve subjects walked on a level treadmill at a range of walking speeds (0.6 m/s - 1.6 m/s) with and without a backpack containing 40% of their body mass. It was hypothesized that compared to unloaded walking load carriage decreases transverse pelvic and thoracic rotation, the mean relative phase between pelvic and thoracic rotations, and increases hip excursion. In addition, it was hypothesized that these changes would coincide with a decreased stride length and increase stride frequency. The findings supported the hypotheses. It was additionally hypothesized that the increased MOI of the upper body caused by the added mass of the backpack would result in an increase in upper body torque, an increase in lower body torque, and an increase in net body torque. Higher levels of upper body torque were observed in the backpack condition compared to the no backpack condition. However, the increase in upper body torque was 225%, while upper body MOI increased by 400%. In contrast to our hypothesis, decreased lower body torque was also observed in the backpack condition compared to the no backpack condition. Dimensionless analyses indicated that there was a significantly larger contribution of hip excursion and smaller contribution on transverse plane pelvic rotation to increases in stride length during load carriage. In addition, there was a significant effect of load carriage on the amplitudes of transverse pelvic and thoracic rotation and the relative phase of pelvic and thoracic rotation. It was concluded that the shorter stride length and higher stride frequency observed when carrying a backpack is the result of decreased pelvic rotation.



The shorter stride length and higher stride frequency observed during load carriage are associated with changes in transverse plane kinematics.

DTIC

*Walking; Physical Fitness; Treadmills; Baggage*

**20030010479** Stanford Univ., Stanford, CA USA

**Beam Delivery Verification for Modulated Electron Radiation Therapy Treatment of Breast Cancer** *Annual Report, 1 Aug. 2001-31 Jul. 2002*

Lee, Michael C.; Ma, Chang-Ming; Boyer, Arthur L.; Pawlicki, Todd; Aug. 2002; 7p; In English

Contract(s)/Grant(s): DAMD17-01-1-0402

Report No.(s): AD-A408715; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

We have analyzed the delivery of a novel form of radiation therapy for the treatment of breast cancer: modulated electron beam radiation therapy (MERT). The perturbations introduced by a realistic collimator system have been assessed using Monte Carlo radiation transport simulations. The changes in the electron and photon fluence have been quantified and found to be non-trivial. In particular the electron beam penumbras may be changed by interaction with the electron multileaf collimator, and photon contamination contributes significantly to the total energy fluence. An optimization system for correcting for these perturbations has been developed and reported. We propose a two stage optimization, in which the first stage selects leaf positions, while the second stage sets segment weights. This system satisfies two key requirements: the treatment plan is optimized with the inclusion of knowledge of realistic delivery effects, and the computed fluence is an accurate representation of the delivered fluence. The accuracy of the computed fluence model is necessary for any beam verification system for MERT.

DTIC

*Radiation Therapy; Mammary Glands; Cancer*

**20030010480** Cornell Univ., Ithaca, NY USA

**Direct Effects of Folate Metabolism on Gene Expression in Metastatic Breast Cancer** *Annual Report, 1 Jul. 2001-30 Jun. 2002*

Calero, Monica; Collins, Ruth N.; Jul. 2002; 34p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-00-1-0218

Report No.(s): AD-A408721; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Rab proteins are small GTPases that are essential elements of the protein transport machinery of eukaryotic cells. Each round of membrane transport requires a cycle of Rab protein nucleotide binding and hydrolysis. My research project consists in the study of Rab GTPases, the way in which they regulate intracellular transport, and the elucidation of mechanisms by which proteins involved in intracellular protein trafficking are linked to uncontrolled cellular proliferation and cancer. Our laboratory has extensively characterized Yiplp and Yoplp, membrane proteins which appear to play a role in Rab-mediated membrane transport in *Saccharomyces cerevisiae*. This past year I have further characterized other Rab interacting membrane proteins that are homologs of Yiplp. I have also cloned the mammalian homolog of Yiplp and initiated its characterization in mammalian cells. I will present exciting new evidence on the important role of prenylation in Rab protein localization and function and a potential role for Yiplp as a specific factor that binds the di-geranylgeranylated Rab. The results will be discussed in terms of the relevance to treatment for human cancers.

DTIC

*Metabolism; Mammary Glands; Folic Acid; Cancer*

**20030010481** Washington State Univ., Pullman, WA USA

**Pim-1, a Potential Participant in Breast Cancer** *Annual Report, 1 Jul. 2001-30 Jun. 2002*

Meyer, Maria; Magnuson, Nancy S.; Jul. 2002; 7p; In English

Contract(s)/Grant(s): DAMD17-00-1-0491

Report No.(s): AD-A408723; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Pim-1, a serine/threonine kinase involved in proliferation, differentiation and survival, is a protooncogene involved in cancers of hematopoietic origin. Once thought only to be expressed in hematopoietic cells, it also is expressed in many cell types including epithelial cells. It is therefore suspected that Pim-1 may also play a role in promoting breast cancer. We are examining how Pim-1 expression is regulated in mammary epithelial cells where a signaling pathway called the JAK2/Stat5a (Janus kinase 2/Signal transducer and activator of transcription 5a) pathway, is activated by hormones such as prolactin. This pathway is suspected to regulate pim-1 transcription. To date, wild type, constitutively active and dominant negative mutants of Stat5a have been made. Mammary epithelial cells have been treated with prolactin and a dose-dependent response has been observed which correlates

to Stat5a phosphorylation state. It appears the three cell lines used, which differ in their progesterone and prolactin receptor levels, do not contain equal basal levels of Pim-1 and do not respond identically to prolactin and progesterone stimulation. It is suspected that the ability of these hormones to regulate expression of Pim-1 in mammary epithelial cells allows cells to survive and accumulate mutations resulting in a cell becoming cancerous.

DTIC

*Activation; Hematopoietic System; Mammary Glands; Cancer*

**20030010482** Wisconsin Univ., Madison, WI USA

**The Role of Amplified Wild-Type Neu in the Etiology of Breast Cancer** *Annual Report, 1 Jul. 2001-30 Jun. 2002*

Gould, Michael N.; Jul. 2002; 19p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-01-1-0459

Report No.(s): AD-A408726; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Many human breast cancers have amplified wild-type Neu (Her2) protooncogenes. It is still not known from either human or rodent models if amplified wild-type Neu is involved in the etiology of breast cancer. We have begun to develop rat transgenic models. Under the first aim we will construct additional Neu transgenic rat lines. Aim 2 will endocrinologically manipulate female Neu-transgenic rats in a way that models high androgen postmenopausal women. Aim 3 will explore alternative reasons of why these female transgenics do not develop breast cancer. The role of genetic background as it relates to female breast cancer development in this model will be explored. We have produced two independent strains of Neu-transgenic rats that spontaneously develop mammary carcinomas in males. Females supplemented with androgens develop mammary carcinomas. These carcinomas activated Neu by amplification and not by mutagenesis. We have thus developed a useful model of Neu associated mammary carcinogenesis. This answers a key question of whether the amplification of wild-type Neu is only associated with tumor progression or is it also possibly involved in breast cancer etiology. These data presented is the first model to clearly demonstrate that the amplification of wild type Neu can induce mammary cancer.

DTIC

*Etiology; Mammary Glands; Cancer*

**20030010483** Cincinnati Univ., OH USA

**The Role of Plakoglobin in Breast Cancer Cell Motility and Invasion** *Annual Report, 1 Aug. 2001-31 Jul. 2002*

Warren, Mary A.; Aug. 2002; 6p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-01-1-0204

Report No.(s): AD-A408727; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The goal of this project was to determine how plakoglobin (PG) affects cell motility. Others in the Brackenbury laboratory previously isolated variants of the PAM2 12 keratinocyte cell line that expressed low levels of plakoglobin, did not form compact colonies, and had lost contact suppression of motility. These findings implied that plakoglobin is a significant regulator of cell movement. I proposed to analyze how plakoglobin exerted its effect, to determine whether plakoglobin acted in a structural capacity, such as a docking protein or signal transducer, or whether it acted as a transcriptional activator, possibly controlling expression of genes required to suppress motility. During the first year of this fellowship, I found that the original PAM2 12 cell model was unsuitable for further investigation and developed a new model system for analysis, in the process verifying that plakoglobin is required for contact regulation of movement. I also characterized a portion of the human plakoglobin gene, correcting a significant error in the literature and produced mutant plakoglobin constructs that will soon be used to analyze how plakoglobin suppresses movement.

DTIC

*Mammary Glands; Cancer; Cells (Biology)*

**20030010484** Baylor Coll. of Medicine, Houston, TX USA

**Mechanism of Mutation in Non-Dividing Cells** *Annual Report*

Ponder, Rebecca G.; Rosenberg, Susan; Jul. 2002; 11p; In English

Contract(s)/Grant(s): DAMD17-00-1-0145

Report No.(s): AD-A408728; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Stationary-phase mutation is a mutational program that can be induced in non-dividing cells after exposure to environmental stress. We tested the postulate that stationary-phase mutations result from acts of DNA double-strand break repair. In one model for stationary-phase mutation, a DSBR intermediate primes DNA synthesis, during which pol IV, an error-prone polymerase required for stationary-phase Lac<sup>+</sup> mutation, is proposed to create errors that lead to mutation. F plasmid transfer (Tra) proteins are required for stationary-phase reversion of a +1 frameshift mutation on an F' sex plasmid. Tra functions induce single-strand

nicks on the F', which could lead to DSBs. We find that introducing specific breaks on an F' that lacks Tra functions results in 50-2000-fold stimulation of Lac<sup>+</sup> stationary-phase mutation. These results provide the first direct evidence that DNA DSBs can activate stationary-phase mutation and imply that the role of Tra functions is to promote the formation of DSBs. We report that DSB-stimulated mutation requires recombination proteins and DNA pol IV. This indicates that introduction of DSBs activates a similar mechanism to that which produces Lac<sup>+</sup> stationary-phase mutation, and not an alternative pathway, and that the recombination and polymerase functions are required after DSB formation.

DTIC

*Mutations; Cell Division; Mammary Glands; Cancer; Cells (Biology)*

**20030010485** Pennsylvania Univ., Medical Image Processing Group, Philadelphia, PA USA

**Detection of Breast Microcalcifications Under Ultrasound Using Power Doppler and Acoustic Resonance Imaging *Annual Report, 1 Jul. 2001-30 Jun. 2002***

Weinstein, Susan P.; Seghal, Chandra; Jul. 2002; 27p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-00-1-0406

Report No.(s): AD-A408730; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Intraductal breast carcinoma (DCIS) represents approximately one third of mammographically detected breast carcinoma. Currently, DCIS and benign breast microcalcifications can only be reliably be evaluated utilizing x-ray mammography. Our goal with our current project was to utilize breast sonography coupled with the technique of acoustic resonance to image and evaluate the breast microcalcifications in patients prior to biopsy. We have been successful in evaluating the calcifications. However, thus far, our analysis demonstrates no significant difference between the malignant and benign calcifications. Currently, work is ongoing with patient accrual.

DTIC

*Acoustic Resonance; Mammary Glands; Cancer; Ultrasonics; Calcification*

**20030010486** Colorado Univ., Boulder, CO USA

**Selection of Aptamers for CED-9/Bcl-2 Family Cell Death Regulators and Their Application in Study of Apoptosis Regulation and Drug Design for Breast Cancer *Annual Report, 1 Jul. 2001-30 Jun. 2002***

Xue, Ding; Yang, Chonglin; Hatton, Berry; Jul. 2002; 9p; In English

Contract(s)/Grant(s): DAMD17-01-1-0214

Report No.(s): AD-A408736; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A central issue in cancer biology is how a tissue maintains appropriate cell numbers. Apoptosis plays an essential role in controlling cell numbers by inducing the deaths of extra cells. The Bcl-2 family proteins are conserved apoptosis regulators. Overexpression of bcl-2 can cause B-cell lymphoma and likely other human cancers, including breast cancer. How Bcl-2 family proteins act to regulate apoptosis is poorly understood. The major goal of this project is to carry out in vitro selection (SELEX) to identify high affinity and specificity small RNA ligands (aptamers) for CED-9, a C elegans Bcl-2-like apoptosis inhibitor, and three important mammalian Bcl-2 family proteins, and then use isolated aptamers to study how CED-9/Bcl-2 family proteins regulate apoptosis. We have developed and improved the SELEX method and have made progresses and obtained promising results on isolating aptamers for CED-9 and mammalian Bcl-2 proteins. We will continue the screens until high affinity aptamers for CED-9 and other Bcl-2 family proteins are isolated. The studies described here will provide a novel approach and generate new reagents for studying the mechanisms of Bcl-2 family proteins in apoptosis. These studies may also yield potential diagnostic reagents and may generate potent apoptosis-inducing compounds useful in the detection and treatment of breast cancer.

DTIC

*Apoptosis; Cells (Biology); Mammary Glands; Cancer*

**20030010487** Burnham Inst., La Jolla, CA USA

**A Novel Molecular Target for Breast Cancer Prevention and Treatment *Annual Report, 1 Jun. 2001-31 May 2002***

Zhang, Xiao-kun; Jun. 2002; 23p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-01-1-0172

Report No.(s): AD-A408737; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

TR3 is an orphan member of the steroid/thyroid/retinoid receptor superfamily and is known to induce apoptosis of cancer cells. We have investigated the mechanism of TR3-mediated apoptosis in breast cancer cells. Our results demonstrate that TR3 exerts its apoptotic effect in breast cancer by translocating from the nucleus to mitochondria in response to apoptotic retinoids. We have also identified a new apoptotic retinoid MMOO2 that effectively induces TR3 mitochondrial targeting and apoptosis of breast cancer cells. In studying the mechanism by which TR3 migrates from the nucleus to the cytoplasm, we found that the

migration of TR3 from the nucleus to the cytoplasm requires RXR through their heterodimerization. We also observed that RXR contains a nuclear export sequence that is required for its cytoplasmic localization and is regulated by RXR ligands. Furthermore, we discovered that TR3 can physically interact with Bcl-2 and that Bcl-2 acts as a mitochondrial receptor of TR3 and is required for apoptotic effect of TR3 in breast cancer cells. Our results not only enhance our understanding of the molecular mechanism by which TR3 exerts its apoptotic effect in breast cancer cells but also provide novel approaches to induce apoptosis of Bcl-2-expressing breast cancer cells.

DTIC

*Thyroid Gland; Apoptosis; Mammary Glands; Cancer; Prevention*

**20030010488** Brookhaven National Lab., Upton, NY USA

**Differential Expression of DNA Double-Strand Break Repair Proteins in Breast Cells** *Annual Report, 1 Jul. 2001-30 Jun. 2002*

Anderson, Carl W.; Tawde, Mangale; Jul. 2002; 22p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-00-1-0168

Report No.(s): AD-A408738; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Two mechanisms that repair DNA double-strand breaks in mammalian cells are homologous recombination and non-homologous DNA end-joining (NHEJ). Previous studies showed that a critical component of the NHEJ pathway, the DNA-activated protein kinase (DNA-PK), was poorly expressed in non-lactating (resting) breast tissue. Therefore, we proposed to identify the mechanisms responsible for regulating levels of non-homologous end-joining DNA repair components in human breast tissue and to measure the DNA double-strand break repair capacity of breast epithelial cells. We reexamined the expression of DNA-PK in human breast tissues by immuno-histochemistry and extended these studies to two other components of the NHEJ repair pathway, XRCC4 and DNA ligase IV, as well as other DNA repair components including NBS 1 and MRE11. In contrast to the original report, 90% of the epithelial cells in normal resting breast tissues from 10 different patients expressed both components of DNA-PK, DNAPKcs and Ku. In contrast, stromal cells failed to express NHEJ proteins, but a cell line derived from breast stromal tissue did. No polymorphisms were detected in the Ku70 gene of 14 breast cancer patients, but 11.3% of breast cancer patients amplified the gene for the Wip1 phosphatase that regulates p53 activity.

DTIC

*Deoxyribonucleic Acid; Cancer; Mammary Glands; Histochemical Analysis*

**20030010489** Northwestern Univ., Evanston, IL USA

**Regulation of Actin-Myosin Cytoskeletal Changes in Involved in Cancer Metastasis** *Annual Report, 1 Jul. 2001-30 Jun. 2002*

Chew, Teng-Leong; Jul. 2002; 17p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-00-1-0385

Report No.(s): AD-A408739; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Advanced imaging techniques based on fluorescent resonant energy transfer (PRET) has been devised to probe the dynamic regulation of myosin in tumor metastasis. Myosin activity is regulated mainly through the phosphorylation of myosin regulatory light chain (RLC) EtC is the target of multiple signaling cascades. Using a PRET-based biosensor, we have studied the activity and localization of myosin light chain kinase (MLCK) simultaneously. The biosensor highlights the transient recruitment of MLCK to the stress fibers prior to contraction. More importantly, it shows that MLCK is highly active in the lamella of migrating cells, but not the retracting. This unexpected result highlights a potential role for MLCK-mediated myosin contractility in the lamella as a driving force for migration. These findings provide significant ground work for further delineating the role of myosin-mediated motility in metastatic potential of breast cancer cells. Our preliminary results also show that microtubule disruption by nocodazole leads to transient stress fiber association of MtCK, indicating MLC;K as a potential signaling link between the microtubule network and the actomyosin system.

DTIC

*Phosphorylation; Metastasis; Cancer; Mammary Glands; Tumors; Bioinstrumentation*

**20030010490** West Virginia Univ., Morgantown, WV USA

**Regulation of C-myc Gene Expression by Potassium Channel Blocker Quinidine in MCF-7 Human Breast Cancer Cell Line** *Annual Report, 1 Jul. 1999-30 Jun. 2002*

Melkounian, Zaroui; Jul. 2002; 29p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-99-1-9447

Report No.(s): AD-A408742; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche



C-MYC is one of the most common oncogene aberrations in breast cancer, suggesting its important role in the genesis and/or progression of breast cancer. Therefore, it is critical to elucidate the precise molecular mechanisms of c-myc gene regulation. The goal of this proposal was to understand how potassium channel blocker, quinidine, regulates expression of c-myc oncogene in human breast cancer cells. We found that quinidine significantly suppressed c-myc promoter activity and a 168 bp region of human c-myc promoter, a quinidine response region (-100 to +68 with respect to the Pt) is sufficient to confer responsiveness to quinidine. In addition, quinidine suppressed c-myc mRNA and protein levels in four human breast cancer but not normal breast epithelial cell lines. Suppression of Myc by quinidine paralleled by inhibition of growth and induction of a more differentiated phenotype in breast cancer cells. The preferential suppression of c-myc and induction of differentiation in tumor but not normal breast epithelial cells is very interesting and exciting finding. Quinidine is a potential lead compound for developing pharmacological agents to regulate Myc. In addition, the study of quinidine-regulated events is a promising approach to unravel differentiation control pathways that become disrupted in breast cancer.

DTIC

*Ribonucleic Acids; Potassium; Physiology; Viruses; Cancer; Growth; Oncogenes; Mammary Glands*

**20030010492** Chicago Univ., Chicago, IL USA

**Temporal Patterns of Mammary Epithelial Cell Gene Expression in Response to Glucocorticoid Receptor Activation**  
**Final Report, 15 May 2001-14 May 2002**

Conzen, Suzanne D.; Jun. 2002; 5p; In English; Original contains color images

Report No.(s): AD-A408744; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Because GR-mediated transcriptional regulation is required for the potent survival signal observed in MECs we hypothesized that the identification of key targets of GR-activation may lead to novel targets for breast cancer therapy. One approach to hone in on physiologically relevant genes is to analyze multiple time points for gene induction and repression by dexamethasone using microchip technology. This approach successfully allowed us to monitor gene expression at successive times in cells undergoing apoptosis in response to serum withdrawal and compare this set of genes to those expressed over time in cells protected from apoptosis by GTL activation. The concept to be tested was that we might efficiently identify relevant pathways involved in this novel survival signaling pathway by using cluster analysis to examine temporal patterns of expression rather than by simply cataloguing individual genes induced in an array at a single time point following CR activation. We achieved this goal using affymetrix chips and monitoring gene expression over or under baseline 30 minutes, 2 hours 4 hours and 24 hours following GR activation. Several of the gene products we identified are players in key signal transduction pathways involved in cell survival.

DTIC

*Genetics; Mammary Glands; Cancer; Hormone Metabolisms; Gene Expression*

**20030010493** Thomas Jefferson Univ., Philadelphia, PA USA

**Estimation of Tumor Angiogenesis With Contrast Enhanced Subharmonic Ultrasound Imaging** *Annual Report, 1 Jul. 2001-30 Jun. 2002*

Forsberg, Flemming; Jul. 2002; 13p; In English

Contract(s)/Grant(s): DAMD17-00-1-0464

Report No.(s): AD-A408746; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

New contrast-specific imaging modalities such as harmonic imaging (HI) may improve the accuracy of breast ultrasound. Unfortunately, HI suffers from reduced blood-to-tissue contrast resulting from second harmonic generation and accumulation in tissue. As an alternative we propose using subharmonic imaging (SHI) by transmitting at the double the resonance frequency (2fo) and receiving at the subharmonic (fo). SHI has the potential to detect slow, small volume blood flow associated with tumor neovascularity, making early detection and identification of tumors very likely. Hence, the current project proposes to increase the ability of breast ultrasound to differentiate between benign and malignant lesions by combining injection of an ultrasound contrast agent with SHI. to date, a dual-transducer pulse-echo system was built to perform in vitro SHI measurements and experiments were conducted using the contrast agent Optison in a perfusion phantom with realistic neovascular flow Velocities (2 mm/s). Up to 12 dB of subharmonic signal components were measured. It was discovered that the Logiq 700 scanner targeted for implementation of SHI did not have the appropriate hardware configuration for running the software. A completely new Logiq 700 scanner was acquired from GE (free of charge). Three new iterations of SHI software have been developed and initial testing has commenced.

DTIC

*Cancer; Tumors; Imaging Techniques; In Vitro Methods and Tests; Mammary Glands; Ultrasonics*

**20030010494** Rutgers - The State Univ., Piscataway, NJ USA

**Cell Cycle Regulation by TGF Beta Signaling in C. Elegans** *Final Report, 1 Jul. 1999-30 Jun. 2002*

Padgett, Richard W.; Jul. 2002; 47p; In English; Original contains color images

Report No.(s): AD-A408747; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This project aimed to identify new genes that connect TGF beta with cell cycle control. Most breast cancers have altered responses to TGF beta and learning more about how TGF beta controls cell cycle progression is an important avenue for future therapies. Using *C. elegans* as a model system, we have induced cell cycle arrest using mutations in TGF beta that promote dauer formation. Using a *nr::gfp* reporter for cell cycle progression, we have undertaken a genetic screen to find mutations that alleviate the cell cycle repression. In complementary studies, we have used DNA microarrays to profile mRNAs from animals entering the TGF beta-induced dauer phase. Analysis of this data indicates that many known cell cycle regulators have altered expression profiles, as expected. We are mining the microarray data for new and novel genes whose expression profiles mimic those of the known cell cycle regulators. One gene that was found to be down regulated in these experimental conditions is a homolog of down regulated in metastasis (DRIM). DRIM was originally discovered as a gene whose expression changes in breast cancer cells that metastasize to lung cancers. Our data shows that DRIM is a likely downstream target of TGF beta signaling and may be necessary to carry out its growth regulatory effects. Further studies will be necessary to explore DRIM as a possible therapeutic agent.

DTIC

*Cancer; Cells (Biology); Mammary Glands; Metastasis; Mutations*

**20030010495** Johns Hopkins Univ., School of Medicine, Baltimore, MD USA

**Prevention of Breast Cancer by Targeted Disruption of Breast Epithelial Cells** *Final Report, 1 Sep. 1999-31 Aug. 2002*

Sukumar, Saraswati V.; Sep. 2002; 26p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-99-1-9242

Report No.(s): AD-A408748; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We proposed to test the validity of the hypothesis that introduction of recombinant toxins into the confines of the mammary ductal tree through the teat will kill breast epithelial cells. The toxins TUF- and Heregulin-linked *Pseudomonas* exotoxin would be tested in the rat MNU-induced mammary tumor model. In the first year, we injected varying amounts of the TOF a/PE and the Heregulin/PE toxin in rats by the intraductal route. While the toxin was extremely potent in human normal and breast cancer cells in culture, it was ineffective in killing the rat ductal cells. Although highly conserved, the human ligands do not appear to bind to the rodent receptors. We needed to design new toxins to target rat cells. We have completed the construction of a chimeric toxin consisting of the protein transduction domain of the HIV TAT gene to target and enter the cells, and the VPR gene of HIV to cause apoptosis. Expression of this protein in bacteria, and its purification is in progress. We have also demonstrated the efficacy of the intraductal route to cancer prevention and therapy using the NMU mammary tumor model.

DTIC

*Cancer; Mammary Glands; Prevention; Cells (Biology)*

**20030010496** Johns Hopkins Univ., School of Hygiene and Public Health, Baltimore, MD USA

**Premenopausal Levels of Circulating Insulin-Like Growth Factor I and the Risk of Post-Menopausal Breast Cancer: A Population-Based, Nested Case-Control Study** *Annual Report, 15 May 2001-14 May 2002*

Newschaffer, Craig J.; Jun. 2002; 5p; In English

Contract(s)/Grant(s): DAMD17-01-1-0537

Report No.(s): AD-A408749; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

High levels of circulating IGF-1 may be a risk factor for breast cancer. Only one population-based epidemiologic study of IGF-1 and breast cancer measured circulating IGF-1 in serum drawn prior to diagnosis. For post-menopausal breast cancer cases, no association was found. However, these analyses did not include IGF-1 measures from the pre-menopausal period when endogenous IGF-1 exposure is naturally higher and, potentially, more predictive of breast cancer risk. This study is a nested case-control analysis of archived serum samples and existing questionnaire data from the CLUE studies. 5,290 women participated in the prospective CLUE studies -- 129 developed a first, incident invasive breast cancer between 1990 and 1998. Cases diagnosed premenopausally will be excluded. One control will be matched to each case on age, menopausal status, age at menopause, follow-up time, date of each blood draw. Samples will be sent to the lab of Dr. Michael Pollack at McGill University. Plasma IGF-1 and IGFBP-3 concentrations will be determined by enzyme-linked immunoabsorbent assay (ELISA). Statistical analyses will: 1) estimate the association between premenopausal IGF-1 levels (with and without adjustment for IGFBP-3) on postmenopausal breast cancer risk; and 2) determine whether this association differs from that for postmenopausal IGF-1 levels.

DTIC

*Cancer; Mammary Glands; Menstruation; Insulin*

**20030010498** California Univ., Lawrence Berkeley Lab., Berkeley, CA USA

**How Does Nuclear Organization Maintain Normal Mammary Phenotype** *Annual Report, 1 Jul. 2001-30 Jun. 2002*

Lelievre, Sophie A.; Jul. 2002; 21p; In English

Contract(s)/Grant(s): DAMD17-00-1-0226

Report No.(s): AD-A408754; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Matrix protease-mediated degradation of the basement membrane (BM) surrounding breast epithelial units (acini) is associated with tumor progression. It is critical to understand the molecular mechanisms that underlie the maintenance of an intact BM in order to develop anti-cancer strategies. Using a non-malignant human breast epithelial cell line (sl) that differentiate into acini in the presence of extracellular matrix, we have identified earlier a link between the nuclear organization of the protein NuMA, via its C-terminus, and cell phenotype, notably matrix protease expression. We have expressed and purified the NuMA C-terminal histone-fold peptide that may be involved in the regulation of matrix proteases. Using this sequence as bait we have pulled down a 65 kDa ligand in nonmalignant cells but not in tumor cells. The histone-fold sequence has also been expressed in SI cells and the resulting phenotype is being analyzed. We have identified a CH-actin binding domain at the N-terminus of NuMA that may be responsible for the protein anchorage to the cytoskeleton. We have also demonstrated that NuMA shuttles between nucleus and cytoplasm. Altogether our data suggest that NuMA may regulate cell phenotype not only by binding different c-terminus ligands but also by traveling between nucleus and cytoplasm.

DTIC

*Mammary Glands; Cancer; Tissues (Biology); Peptides; Degradation*

**20030010499** Michigan Univ., Ann Arbor, MI USA

**Identification of Novel Mitotic Checkpoint Genes in Breast Cancer** *Final Report, 1 May 2001-30 Apr. 2002*

Petty, Elizabeth M.; May 2002; 14p; In English

Report No.(s): AD-A408761; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Malignant progression in mammary epithelial cells stems from the accumulation of multiple mutations in tumor suppressor genes and protooncogenes. It is widely hypothesized that these mutations arise in part due to some degree of genomic instability. Given most breast cancer cells demonstrate some degree of aneuploidy suggesting chromosomal instability, we wanted to examine breast cancer cells for the relationship of chromosomal instability to alterations in genes and proteins that regulate the mitotic spindle checkpoint. We first characterized the degree of chromosomal instability in breast cancer cells and examined the cells for alterations in known spindle checkpoint genes (MAD2L1, MAD1L1, BUB1, BUBR1, and CDC20) and their related proteins. We then searched for novel proteins that interact with spindle checkpoint proteins and identified EBI. While few alterations were found in BUB1, BUBR1, EBI, and CDC20, we found decreased transcript and protein expression of MAD1L1 and MAD2L1 in breast cancer cells. Mutation analysis of these genes reveals some alterations that may drive malignant progression. Further in vitro and in vivo analyses are underway to characterize how alterations in spindle checkpoint genes may contribute to mammary carcinogenesis.

DTIC

*Genes; Cancer; Mammary Glands; Carcinogens; Tumors*

**20030010500** Wayne State Univ., Detroit, MI USA

**Lymphedema Prophylaxis Utilizing Perioperative Education** *Annual Report, 1 Aug. 2001-1 Aug 2002*

Kosir, Mary A.; Sep. 2002; 13p; In English

Contract(s)/Grant(s): DAMD17-00-1-0495

Report No.(s): AD-A408763; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The purpose is to evaluate perioperative training for lymphedema assessment and protection. The hypothesis is that structured perioperative training in lymphedema protection will decrease lymphedema, the episodes of infection, the time to detection of lymphedema and improve the QOL in patients undergoing axillary dissection and/or radiation therapy for breast cancer as compared to a control group. The specific questions (scope) are 1) what is the incidence of lymphedema and infection during the first three years after surgery among breast cancer patients who received perioperative training in lymphedema protection as compared to a control group? 2) What are the differences in the measured QOL among breast cancer patients during the first three years after surgery that received perioperative education in lymphedema protection as compared to a control group? 3) What are the retention of information on lymphedema protection, and the compliance with arm precautions among breast cancer patients who received perioperative lymphedema training as compared to a control group? Major Findings: During the first 21.5 months of the study, the incidence of lymphedema was 32.9% overall with 40% in the intervention group as compared to 26.8% in the control group. The QOL measures for the intervention group decreased thus far as compared to the control group. The knowledge scores on lymphedema protection were comparable between the two groups. Significance: The lymphedema rate observed overall

thus far, and including acute and chronic lymphedema, is greater than reported in the literature. With a decrease in QOL scores and the same knowledge of lymphedema protection, additional analyses may show other influences on the use of the lymphedema protection knowledge, which may impact lymphedema occurrence. This may shift established practice in lymphedema prevention and detection for breast cancer survivors.

DTIC

*Cancer; Mammary Glands; Evaluation; Hypotheses; Prevention; Protection*

**20030010501** Stanford Univ., Stanford, CA USA

**Identification of Estrogen Receptors and Their Role in Breast Cancer Annual Report**

Sharma, Nandita; Oct. 2002; 7p; In English

Contract(s)/Grant(s): DAMD17-99-1-9384

Report No.(s): AD-A408764; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The development of breast cancer has been linked to a variety of factors, including age, parity, family history and hormonal milieu. Estrogen, the female sex hormone, is a powerful mitogen and promotes neoplastic growth in mammary epithelium. In vitro, estrogens have been shown to modulate human breast cell via alpha and beta estrogen receptors (ER) While ERJ3 is preferentially expressed in normal breast tissue, ERa is abundantly expressed in invasive and in situ ductal carcinomas. Tamoxifen, a nonsteroidal anti-estrogenic drug is widely used for adjuvant therapy of breast cancer. ERa expression is currently the best method to predict if a cancer will respond to hormonal therapy. However, 35% of the primary tumors, which are ERa-positive do not respond to hormone therapy and about 10% of ERa-negative tumors are hormonally responsive. It would immensely beneficial to predict with a greater degree of accuracy how a breast tumor would respond to the treatment with tamoxifen, especially in the light of growing evidence of carcinogenic effects of tamoxifen.

DTIC

*Estrogens; Cancer; Mammary Glands; Carcinogens; Hormones*

**20030010502** South Carolina Univ., Columbia, SC USA

**Do the Effects of Exercise on Breast Cancer Vary With Environment Annual Report, 18 Sep. 2001-17 Sep 2002**

Teas, Jane; Oct. 2002; 11p; In English

Contract(s)/Grant(s): DAMD17-00-1-0659

Report No.(s): AD-A408765; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We propose to study 16 healthy postmenopausal women who normally exercise. We will ask these women to have their blood drawn before and after an hour of exercise outdoors on a sunny day and then a week later indoors on a treadmill in a room with only indoor lighting. We propose that exercise done outdoors will have a different effect on vascular endothelial growth factor (VEGF), hypoxia inducible factors 1 alpha and beta, vitamin D activity, and estrogen metabolism as measured by the ratio of 2 hydroxyestrone and 16 alpha-hydroxyestrone. Elucidation of indoor versus outdoor influences on exercise induced metabolism may be important in understanding variations in reports of the protective nature of exercise on breast cancer prevention.

DTIC

*Physiology; Cancer; Mammary Glands; Physical Exercise; Beta Particles*

**20030010504** California Univ., Los Angeles, CA USA

**Determining if EBV Infection Contributes to Breast Carcinogenesis: Does LMP-1-Mediated Upregulation of EGFR and Bcl-x Affect Breast Cancer Pathogenesis Final Report, 4 Jun. 2001-3 Jun 2002**

Cheng, Genhong; Jul. 2002; 7p; In English

Contract(s)/Grant(s): DAMD17-01-1-0494

Report No.(s): AD-A408770; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Most human breast cancer cells are derived from epithelial cells. Previously studies indicated that about 20% of breast cancer patients carrying tumor cells with overexpression of Her-2/Neu. Herceptin, an antagonist antibody against Her-2/Neu, has been used in clinic for the treatment of breast cancers overexpressing Her-2/Neu. We found that EGFR and Her-2/Neu are highly overexpressed in tumor cells in approximately 30% and 23% of human breast cancer tumor samples, respectively. Interestingly, Overexpression of EGFR and Overexpression of Her-2/Neu do not overlap in most of breast cancer tumor samples. These results suggested that patients with breast cancers should receive different treatments based on their gene expression profiles. For example, breast cancer patients carrying tumors with overexpression of Her-2/Neu should be treated with Her-2/Neu antagonists such as Herceptin, while patients carrying tumors with overexpression of EGFR should be treated with EGFR antagonists.

DTIC

*Cancer; Mammary Glands; Infectious Diseases; Tumors; Pathogenesis; Carcinogens*



**20030010505** Baylor Coll. of Medicine, Houston, TX USA

**Gene Targets of C/EBPbeta Involved in Mammary Gland Development and Breast Cancer** *Annual Report, 1 Jul. 2001-30 Jun. 2002*

Grimm, Sandra L.; Rosen, Jeffrey M.; Jul. 2002; 11p; In English

Contract(s)/Grant(s): DAMD17-00-1-0138

Report No.(s): AD-A408776; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Targeted deletion of the bZIP transcription factor, C/EBPbeta, was shown previously to result in aberrant ductal morphogenesis and decreased lobuloalveolar development, accompanied by an altered pattern of progesterone receptor (PR) expression. Similar changes in the level and pattern of prolactin receptor (PrIR) expression were observed while screening for differentially expressed genes in C/EBPbeta KO mice. PR patterning was also altered in PrIR KO mice, as well as in mammary tissue transplants from both PrIR KO and Stat5a/b-deficient mice, with concomitant defects in hormone-induced proliferation. Down-regulation of PR and activation of Stat5 phosphorylation were observed following estrogen and progesterone treatment in both C/EBPbeta KO and wild-type mice indicating that these signaling pathways were functional, despite the failure of steroid hormones to induce proliferation. IGFBP-5, IGF-II, and IRS-I all displayed altered patterns and levels of expression in C/EBPbeta KO mice, suggestive of a change in the IGF signaling axis. In addition, SPRR2A, a marker of epidermal differentiation, and keratin 6 were misexpressed in the mammary epithelium of C/EBPbeta KO mice. Together, these data suggest that C/EBPbeta is a master regulator of mammary epithelial cell fate and that the correct spatial pattern of PR and PrIR expression is a critical determinant of hormone-regulated cell proliferation

DTIC

*Genes; Mammary Glands; Cancer; Targets; Pituitary Hormones; Phosphorylation; Hormones*

**20030010506** Colorado Univ., Boulder, CO USA

**Breast Cancer Therapeutics, Environmental Estrogens, and the Estrogen Receptor (ER); Characterization of the Diverse Ligand Binding Properties of the ER** *Annual Report, 1 Jul. 2001-30 Jun. 2002*

Wuttke, Deborah S.; Jul. 2002; 15p; In English

Contract(s)/Grant(s): DAMD17-99-1-9148

Report No.(s): AD-A408777; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The estrogen receptor (ER) is found in the nucleus of several tissues, including breast, bone, liver, the organs of the reproductive system, and the cardiovascular system. The ER binds several types of compounds, including compounds that are quite distinct from its natural ligand. Estrogens bind to and activate the ER, which leads to the stimulation of transcription of genes containing an estrogen responsive element (ERE). Antiestrogens and partial antiestrogens bind tightly to the ER but fail to activate transcription; these compounds are currently in widespread use for the treatment of breast cancer. In addition, a variety of compounds introduced into the environment by human activity have also been found to act as estrogen mimics and alter reproductive function and development. The goals of this project are to understand, on a molecular level, how the ER binds estrogens, anti-estrogens, and estrogen mimics present in the environment, how this binding triggers activity, and how mutations in the ER discovered in breast cancer patients affect ER activity. Towards this end, we have expressed and purified the ligand binding domain of the estrogen receptor, and studied complexes with estradiol, the natural ligand, and tamoxifen, a partial antiestrogen in use as a breast cancer therapeutic using high-resolution heteronuclear NMR spectroscopy.

DTIC

*Cancer; Mammary Glands; Estrogens; Ligands; Human Reactions*

**20030010507** Toledo Univ., OH USA

**Contrast Agents for Breast Cancer Diagnosis by Magnetic Resonance Imaging: Targeting the Folate Receptor** *Annual Report, 1 Jul. 2001-30 Jun. 2002*

Davies, Julian A.; Jul. 2002; 9p; In English

Contract(s)/Grant(s): DAMD17-01-1-0652

Report No.(s): AD-A408779; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Folate receptors are overexpressed on a variety of human cancer cells, including breast cancer cells, but are highly restricted in normal tissues. Folate-conjugated radiopharmaceuticals have shown specificity for folate-receptor-bearing cells and promise in cancer imaging in animal models. We proposed to explore the coupling to folate of a series of MR contrast agents and work is in progress in this area. Folate is being coupled with a series of ligands for complexation with paramagnetic metal ions, including iron(III) and gadolinium(III) to yield a series of new MR contrast agents. Following completion of the synthesis and characterization of these novel contrast agent-conjugates, selectivity for breast cancer cells that overexpress the high-affinity folic

acid receptor will be examined Chinese hamster ovary (CHO) cells that have been modified to overexpress FR-beta have been cloned and grown. Western blot analysis has been performed to confirm the overexpression of FR-beta.

DTIC

*Cancer; Mammary Glands; Pharmacology*

**20030010508** Sloan-Kettering Inst. for Cancer Research, New York, NY USA

**Influence of Radiotherapy and Tamoxifen on Contralateral Cancer Risk in Women With Hereditary Breast Cancer**  
*Annual Report, 1 Jul. 2001-30 Jun. 2002*

Robson, Mark E.; Jul. 2002; 7p; In English

Contract(s)/Grant(s): DAMD17-01-1-0325

Report No.(s): AD-A408781; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Women with breast cancer arising as a consequence of germline mutations in BRCA1 or BRCA2 are known to be at significant risk of contralateral breast cancer (CBC). Our group has reported that approximately 25% of Ashkenazi women undergoing breast conserving treatment for hereditary breast cancer develop CBC within 10 years. Examination of factors influencing contralateral risk will provide insight into prevention strategies for unaffected women with BRCA mutations at risk for hereditary breast cancer. to evaluate these factors, the funded study is evaluating the impact of tamoxifen and radiotherapy on CBC risk. In this reporting period, the human subjects protocol was developed and approved by the local IRS and the relevant DOD authority. Tamoxifen treatment data were acquired and analyzed for the 305 women in the original 1980-1990 dataset. Mutation carriers taking tamoxifen were found to have a non-significant reduction in contralateral risk (0.57 95% CI: 0.07-4.57; p=0.6). These data will be presented at the 2002 Era of Hope meeting. Dataset expansion continues per the SOW. 422 additional Ashkenazi women with invasive breast cancer (1990-1992) and available tissue have been identified, and clinical data collection is underway. Further cases are being identified in the 1992-1994 time period.

DTIC

*Genetics; Cancer; Radiation Therapy*

**20030010509** Baylor Coll. of Medicine, Houston, TX USA

**Identification and Characterization of Components of the Mitotic Spindle Checkpoint Pathway Using Fission Yeast**  
*Annual Report, 1 Jul. 2001-30 Jun. 2002*

Kadura, Sheila; Sazar, Shelley; Jul. 2002; 25p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-00-1-0140

Report No.(s): AD-A408789; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

During anaphase of mitosis, sister chromatids are separated by the mitotic spindle. The spindle assembly checkpoint protects the integrity of the genome by initiating a cell cycle delay if chromosomes are not properly attached to the spindle. Cells lacking a functional spindle checkpoint may gain or lose genetic information, which can cause cell death or predispose cells to cancer. For example, loss of checkpoint function has been observed in human cancer cell lines, and decreased expression of the checkpoint component, hSMAD2, has been demonstrated in human breast cancers. Most human spindle checkpoint components were identified by their similarity to yeast checkpoint proteins that were discovered through genetic screens. Many aspects of spindle checkpoint function are not yet understood, and genetic evidence indicates there are additional checkpoint proteins that have not been identified. This project aims to use genetic screens in fission yeast to identify and characterize novel components of the yeast and animal spindle checkpoint pathways and novel mutant alleles of known yeast spindle checkpoint genes. to date, mutations in three known yeast spindle checkpoint genes and a mutation in a potentially novel component of the yeast checkpoint pathway have been identified. A second genetic screen has been initiated to identify mouse cDNAs which induce a metaphase arrest in fission yeast and may encode spindle checkpoint proteins. The genes identified by these studies will be used to further elucidate the mechanism of spindle checkpoint function.

DTIC

*Chromosomes; Mitosis; Cancer; Genetics; Yeast*

**20030010510** Florida Univ., Dept. of Chemistry and Physics, Gainesville, FL USA

**Improving the Efficiency of Enzymatic Baeyer-Villiger Oxidations With Whole Engineered Escherichia coli Cells**

Walton, Adam Z.; Dec. 20, 2002; 72p; In English

Report No.(s): AD-A408811; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The aim of this work is to develop methodology for conducting whole cell biocatalysis that greatly improves its productivity and therefore overcomes the primary disadvantages associated with this technique: long reaction times and low product titers. The model system used for this work is a recombinant Escherichia coli strain that over expresses the enzyme cyclohexanone

monooxygenase (CHMO), originally isolated from *Acinetobacter* sp. NCIB 9871 (Chen et al., 1999). We believe that the results achieved here may drastically enhance the potential commercial viability of this enzyme as well as many other whole cell biocatalysis applications.

DTIC

*Enzymes; Cyclic Compounds; Escherichia*

**20030010512** Maryland Univ., Baltimore, MD USA

**Inhibition of Tumor cells that Over-Express nGST Annual Report, 1 Jul. 2001-30 Jun. 2002**

Creighton, Donald J.; Jul. 2002; 86p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-99-1-9275

Report No.(s): AD-A408826; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

In the third and final year of this three year project, we have characterized 2crotonyl-oxymethyl-2- cyclohexenone (COMC-6) and its derivatives as substrates for human glutathione transferase (hGST), producing as products cytotoxic alkylating agents of nucleic acids and/or proteins critical to cell function. Compounds of this type should be potent antitumor agents against breast cancer cells over expressing GST as part of the multidrug resistance phenotype. Specifically, we have (a) discovered that hGSTP1-1 efficiently catalyzes the conversion of COMC-6 to a reactive exocyclic enone of COMC-6, (b) shown that the exocyclic enone can alkylate oligonucleotides in vitro--the probable basis of antitumor activity (c) synthesized and characterized the 5- and 7-membered ring homologues of COMC-6 (COMC-5, COMC-7) and demonstrated that COMC-6 is more potent to B16 tumor cells than COMC-6 in vitro, and (d) demonstrated that COMC-6 displays similar toxicities to human colon HT29 versus HT29 over-expressing the phosphoglycoprotein responsible for some type of multidrug resistance. We are now in the process of testing the in vitro tumoricidal activities of COMC-6 and its homologues to MCF-7 breast tumor cells versus MCF-7 over-expressing hGSTP1-1.

DTIC

*Drugs; Nucleic Acids; Glutathione; Cancer; Cells (Biology)*

**20030011253** New Jersey Medical School, Newark, NJ USA

**The Roles of FGF-2, TGF Beta and TGF Beta Receptor 2 in Breast Cancer Dormancy Annual Report, 1 Jul. 2001-30 Jun. 2002**

Wieder, Robert; Jul. 2002; 14p; In English

Contract(s)/Grant(s): DAMD17-01-1-0343

Report No.(s): AD-A408702; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We determined the expression of FGF-2 during steps of mammary ductal dedifferentiation as preliminary investigations in understanding its role in dormancy and relapse of microscopic metastases. Preliminary data suggest that initial low level expression of FGF-2, primarily in myoepithelial cells of normal ducts, is markedly upregulated during ductal hyperplasia, only to be lost with malignant progression. The previously established role of FGF-2 as a morphogenic differentiation agent suggests this to be a reactive process by ductal cells during the uncontrolled proliferation of hyperplasia, an effect largely lost with malignant transformation. More samples will be stained to allow for statistically significant correlations. These data will support a role for FGF-2 expression as a differentiation agent if found in dormant malignant micrometastases in the bone marrow of patients to be stained in this project. To provide mechanistic support, the In vitro effects of FGF-2 were determined on breast cancer cell lines. FGF-2 caused a large reduction of well-differentiated breast cancer cells, inhibited clonogenicity in tissue culture and caused massive upregulation of integrin alpha5 expression. The ligation of integrin alpha5 by fibronectin specifically provided survival signaling and partly restored clonogenicity to the non-growing cells. These experiments provide a paradigm for dormancy.

DTIC

*Fibroblasts; Mammary Glands; Cancer; Physiological Defenses; Growth*

**20030011256** Georgetown Univ., Medical Center, Washington, DC USA

**Endothelial Cell-Based Gene Therapy of Breast Cancer Final Report, 1 Aug. 1998-31 Jul. 2002**

Ojeifo, John O.; Aug. 2002; 14p; In English

Contract(s)/Grant(s): DAMD17-98-1-8094

Report No.(s): AD-A408714; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Recurrence and metastatic dissemination of breast cancers account for a significant morbidity and mortality in women, and effective means of treating this subset of patients remain elusive. The reports that intravenously (IV)-administered, genetically modified endothelial cells (GMBC) can target and incorporate into sites of active angiogenesis suggest that this strategy may be

useful for the treatment of metastatic breast cancer. We evaluated whether IV-injected, interleukin (IL)-2 or IL12 gene-modified murine microvascular endothelial cells (IL-2/GMBC) can target sites of metastatic breast cancer, and whether the expression of hIL-2 or mL-12 transgene at the local tumor site can induce an anti-tumor immune response. Systemic administration of hIL-2/GMEC mediated significant reduction in the tumor burden of breast cancer and prolonged the survival of tumor-bearing mice. Immunocytochemical analysis of explanted tumors demonstrated presence of immune effectors (granulocytes, macrophages, CD4+ and CD8+ lymphocytes) within and around rhIL-2 positive tumors. Mice, which received only the hIL-2/GMEC without tumor cells, did not develop tumors and remained alive and well. Initial studies of tumor-bearing mice treated with IL-2/GMEC also show promising results. These findings suggest that systemic administration of GMEC is a potentially effective and safe strategy to target and treat metastatic breast cancer.

DTIC

*Endothelium; Gene Therapy; Mammary Glands*

**20030011257** Nebraska Univ., Medical Center, Omaha, NE USA

**Magnetic Resonance Studies of Photosensitizers and Their Effect in Tumors** *Annual Report, 15 Jul. 2001-14 Jul 2002*

Ramaprasad, Subbaraya; Aug. 2002; 59p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-99-1-9065

Report No.(s): AD-A408716; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The main goal of this project is to study the fluorine labeled photosensitizers in the treatment of tumor models of relevance to breast cancer by photodynamic therapy. This study will use <sup>19</sup>F MR spectroscopy to determine the accumulation of photosensitizers in the tumor mass and the time at which maximum accumulation occurs in the tumor. Tumor destruction is achieved via appropriate laser irradiation when there is maximum amount of photosensitizer in the tumor volume. The rate of absorption and the peak times will be obtained to perform photodynamic therapy (PDT) studies involving the labeled photosensitizers. In vivo Phosphorous-31 NMR will be utilized before and after initiation of PDT to determine the effectiveness of this spectroscopic technique in predicting PDT outcome. Finally the <sup>1</sup>H MR diffusion imaging will be performed at several time points post PDT treatment to obtain a complete picture of tumor necrosis and tissue viability. The combined use of the multinuclear techniques on tumor model can provide significant information towards breast cancer treatment by PDT.

DTIC

*Magnetic Resonance; Mammary Glands; Cancer; Photosensitivity*

**20030011258** Cornell Univ., Medical Coll., New York, NY USA

**Bioenergetic Defects and Oxidative Damage in Transgenic Mouse Models of Neurodegenerative Disorders** *Annual Report, 1 May 2001-30 Apr. 2002*

Brown, Susan E.; May 2002; 47p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-98-1-8620

Report No.(s): AD-A408717; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This project aimed to determine the contributions of bioenergetic dysfunction and oxidative stress to neurodegeneration in Huntington's disease (HD) and amyotrophic lateral sclerosis (ALS). We found elevations in cerebral glucose utilization in two distinctly different mutant mouse models of HD: Hdh(Q92) and N171-82Q. Hypermetabolism preceded pathologic changes and symptoms, but was not accompanied by alterations in oxidative phosphorylation enzyme activities. We also found late increases in oxidative damage to DNA and lipids in R6/2 and N171-82Q HD mice. Another approach to model HD is to inhibit mitochondrial complex II using the neurotoxin 3-nitropropionic acid (3-NP). In contrast to genetic models, reductions in glucose use following 3-NP coincided with neuronal loss, suggesting a different sequence of pathologic events in this model. In a model of ALS, G93A mice, we also found early metabolic changes preceding neuronal pathology and symptom onset. Reduced glucose utilization in brain and spinal cord at 60 days of age was concomitant with increased mitochondrial complex I activity and depletions in ATP levels. Elevated free radical generation was evident by 90 days. Results clearly demonstrate the early involvement of metabolic changes in the pathologic events initiated by expression of the mutant disease gene in ALS and HD models.

DTIC

*Stress (Physiology); Cells (Biology)*

**20030011314** National Inst. of Health, Bethesda, MD USA

**STAT5A Regulates the Survival of Mammary Epithelial Cells and the Development of Mammary Cancer** *Annual Report, 1 Jul. 1999-30 Jun. 2002*

Cui, Yongzhi; Humphreys, Robin; Bierie, Brian; Jul. 2002; 44p; In English



Contract(s)/Grant(s): DAMD17-99-1-9328

Report No.(s): AD-A408678; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Members of the epidermal growth factor receptor (EGFR) family play a significant role in the initiation and progression of mammary epithelial cell transformation. EGFR stimulation can initiate mitogenic signaling through STAT proteins, particularly Stat5a and Stat3. Previously, we have reported that in the presence of an activated EGFR, deletion of Stat5a from the mammary epithelium, delayed mammary involution by 9 days, and hyperplasia and mammary tumor development by 6 weeks. These observations demonstrate that Stat5a is a survival factor and is involved in delaying mammary tumorigenesis. To evaluate the role of Stat5a and Stat3 in breast tumorigenesis, we examined Stat5a and Stat3 protein expression and activation in breast tumors derived from MMTV-Neu, MMTV-Py-V-MT and MMTV-int3 transgenic mice. We found that the tyrosine phosphorylation level of both Stat5a and Stat3 were elevated in MMTV-Neu breast tumors. To understand how the EGFR and its downstream kinase signaling pathway contributes to mammary epithelial cell transformation, we used the ErbB kinase inhibitor, AG1478; MAPK kinase (MEM) inhibitor, PD98059; Src kinase inhibitor, PP2; and Jak2/3 kinase inhibitor, AG490 in ErbB2-dependent BT-474, SKBR-3, and MDA-MB-231 human breast cancer cells. Treatment of these cell lines in vitro with the kinase inhibitors resulted in reversible G1 arrest in BT-474 and MDA-MB-231 cells. We are utilizing unique combinations of transgenic(MMTV-Neu) and knockout (Stat3 conditional KO and Stat5a null) mouse models to address the specific contribution of Stat5a and Stat3 in mammary epithelial transformation in vivo. Together these experiments will allow us to evaluate the contribution of these proteins in the initiation and progression of EGFR dependent mammary tumorigenesis.

DTIC

*Mammary Glands; Cancer; Enzyme Activity; Phosphorylation*

**20030011317** Pennsylvania State Univ., Coll. of Medicine, Hershey, PA USA

**Neoplastic Consequences of a Mutator Phenotype in Human Breast Epithelial Cells: A Prospective Analysis** *Annual Report, 1 Jul. 2001-30 Jun. 2002*

Eckert, Kristin A.; Welch, Danny R.; Jul. 2002; 10p; In English

Contract(s)/Grant(s): DAMD17-00-1-0395

Report No.(s): AD-A408674; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Overexpression of DNA polymerase beta in the breast epithelial cell line, MCF-10A, resulted in loss of proliferative potential, most probably due to the upregulation of pro-apoptotic proteins, such as Hax. The ras-transformed MCF-10AT cell line is more tolerant of pol-beta overexpression, possibly due to the increased levels of Bcl-2 protein in these cells. However, the MCF-10AT cells continue to display a progressive loss of proliferative potential resulting from pol-beta overexpression. We observed an alteration in MCF-10AT cell phenotype from an adherent to a floating cell morphology after pol-beta overexpression. This is a novel observation and may be related to underlying genomic changes resulting from increased pol-beta protein levels. MCF-10AT cells overexpressing poln displayed a tumor incidence and latency similar to parental cells. Thus, in contrast to what we observe in cell culture, a subpopulation of pol-beta overexpressing cells retains proliferative potential in vivo. We hypothesize that biologic selection occurs for a mutant, MCF-10AT/WTpol-beta cell variant within the mouse environment. The requisite genetic variation may be related to the adherent to floating morphology change. The observations that the MCF-10AT/pol-beta tumors are sac-like rather than solid, and that animals bearing MCF-10AT/pol-beta tumors progressed to form lung metastases, further supports our hypothesis.

DTIC

*Neoplasms; Mutations; Cancer; Genetics; Metastasis*

**20030011336** Texas Univ., Health Science Center, San Antonio, TX USA

**Role of Autocrine Motility Factor in Osteolytic Metastasis** *Final Report, 1 Apr. 1998-31 Mar. 2002*

Chirgwin, John M.; Apr. 2002; 15p; In English

Contract(s)/Grant(s): DAMD17-98-1-8245

Report No.(s): AD-A408718; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Autocrine motility factor (AMF) is expressed by human breast cancer cells, such as MCF7 where its expression is stimulated by heregulin. Tumor cells constitutively secreting mouse AMF caused periosteal new bone formation in two different models of metastasis—an osteoblastic response similar to what is found with about 15% of breast cancers metastatic to bone. Whenever serum AMF concentrations were significantly increased, the animals displayed tumor-associated weight loss (cachexia), a major cause of morbidity and mortality in advanced disease. The effects of AMF on bone were independent of PTHrP, which plays a central role in osteolytic bone metastases. We also have determined the clearance rate of AMF from the mouse circulation. The species-specific effects of AMF remain little understood; so we undertook to clarify the structure: function relationships involved. We cloned, sequenced and expressed rabbit AMF, for which the x-ray crystallographic data were already partially solved. These

results have been published. We also developed a recombinant protein expression system for the mouse and human factors, which we now prepare in 100mg batches. The human factor has been crystallized and the x-ray structure solved to 1.8Å.

DTIC

*Bones; Metastasis; Mammary Glands; Cancer*

**20030011339** Wyle Labs., Inc., San Antonio, TX USA

**Gender Not a Risk for Altitude Decompression Sickness Risk** *Final Report, 1 Oct. 1995-30 Nov. 2002*

Webb, James T.; Kannan, Nandini; Pilmanis, Andrew; Oct. 2002; 16p; In English

Contract(s)/Grant(s): F-33615-92-C-0018; F-41624-97-D-6004; Proj-7184

Report No.(s): AD-A408816; AFRL-HE-BR-TR-2002-0212; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We conducted 25 altitude chamber decompression exposure profiles incorporating both genders in a prospective attempt to clarify the role of gender in DCS susceptibility. METHODS. The 291 human subjects were exposed (961 subject-exposures) to simulated altitude for up to 8 h, using zero to 4 h of preoxygenation. Subjects breathed 100% oxygen, rested or performed mild or strenuous exercise while decompressed, and were monitored for precordial venous gas emboli (VUE) and DCS symptoms. RESULTS. No differences ( $P=0.24$ ) in DCS incidence were observed between males (49.5%) and females (45.3%). Higher DCS incidence ( $P$  is less than 0.001) was observed in the heaviest males, females with the highest body fat, and in subjects with the highest body mass indices and lowest levels of fitness. CONCLUSION. No differences in altitude DCS incidence were observed between males and females under our test conditions. No apparent need exists for changes in procedures, training, or equipment to enhance protection from DCS based on gender.

DTIC

*Decompression Sickness; Altitude Simulation; Pressure Reduction*

**20030011344** Ohio State Univ., Research Foundation, Columbus, OH USA

**Development of an erbB Antagonist** *Annual Report, 1 Jul. 1999-30 Jun. 2002*

Simcox, Amanda A.; Jul. 2002; 11p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-99-1-9340

Report No.(s): AD-A408845; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Receptor tyrosine kinases of the erbB family play pivotal roles in growth and differentiation and aberrant activation of these receptors is associated with human cancers. In particular, ErbB-2 dysfunction has been linked to about 30% of breast cancers with poor prognosis. Correspondingly, great efforts are being made to develop therapies that target ErbB pathways. ErbB-2 is activated by the neuregulins in heterodimers with the neuregulin receptors ErbB-3 and ErbB-4. An antagonistic neuregulin that down regulates ErbB signaling could function as an anti-tumor agent. The purpose here is to develop such a factor. In previous work, the Drosophila system was used to demonstrate that an antagonistic neuregulin-like factor could be made by deleting the EGF domain or by insertion of the EGF domain from a natural inhibitor. In this project, a vertebrate neuregulin-1 with an EGF domain deletion (NRG-DELTA-EGF) and a factor with the EGF domain from the inhibitor (NRG::Aos-EGF) were made. The activity of the factors is being tested in transgenic mice by examining heart defects which are characteristic of neuregulin defects. NRG-DELTA-EGF transgenic embryos show no apparent heart defects, however, data from Drosophila suggest the NRG::Aos-EGF will be a stronger inhibitor. Studies are underway for NRG::Aos-EGF transgenes and will be completed during a one-year no-cost extension of the project.

DTIC

*Mammary Glands; Chemotherapy; Cancer; Physiological Defenses*

**20030011349** California Univ., San Francisco, CA USA

**Outcomes of Screening Mammography in Elderly Women** *Annual Report, 1 Oct. 2000-30 Sep. 2001*

Smith-Bindman, Rebecca; Oct. 2001; 24p; In English

Contract(s)/Grant(s): DAMD17-99-1-9112

Report No.(s): AD-A408866; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

There is uncertainty about whether women older than age 65 should undergo screening mammography. Although screening mammography may benefit some elderly women through the detection of early breast cancers, it may harm other women through false positive diagnoses and the detection of clinically insignificant lesions. This research study involves the design and implementation of a data analysis of HCFA Medicare billing claims linked with National tumor registry data from the Surveillance Epidemiology and End Results (SEER) program. The specific aims of this research will evaluate: (1) differences in breast cancer mortality; (2) differences in breast cancer treatment; (3) difference in breast cancer tumor attributes between women who were screened and those who were not. In the second year of this grant the PI focused on validating that the Medicare claims are accurate

for determining screening mammography. She obtained data from three Breast Cancer Surveillance Consortium Registries (New Mexico, Seattle, and San Francisco) that prospectively collect screening information, has linked this with the Medicare/SEER data, and is currently determining whether Medicare claims accurately assess mammography utilization. Following completion of this validation study (6 months) the PI will analyze differences in breast cancer treatments, tumor characteristics and mortality based on screening.

DTIC

*Mammary Glands; Cancer*

**20030011383** NASA Ames Research Center, Moffett Field, CA USA

**Seeking the Light: Gravity Without the Influence of Gravity**

Sack, Fred, Ohio State Univ., USA; Kern, Volker, NASA Ames Research Center, USA; Reed, Dave, NASA Kennedy Space Center, USA; STS 107 Shuttle Press Kit: Providing 24/7 Space Science Research; Dec. 16, 2002, pp. 34-35; In English; Also announced as 20030011376; Original contains color illustrations

Report No.(s): NASA/KSC-2002-057e; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

All living things sense gravity like humans might sense light or sound. The Biological Research In Canisters (BRIC-14) experiment, explores how moss cells sense and respond to gravity and light. This experiment studies how gravity influences the internal structure of moss cells and seeks to understand the influences of the spaceflight environment on cell growth. This knowledge will help researchers understand the role of gravity in the evolution of cells and life on earth.

Derived from text

*Spaceborne Experiments; Gravitational Effects; Life Sciences; Bryophytes; Phototropism*

**20030011384** NASA Johnson Space Center, Houston, TX USA

**A Good Neighborhood for Cells: Bioreactor Demonstration System (BDS-05)**

Chung, Leland W. K., Emory Univ., USA; STS 107 Shuttle Press Kit: Providing 24/7 Space Science Research; Dec. 16, 2002, pp. 36-37; In English; Also announced as 20030011376; Original contains color illustrations

Report No.(s): NASA/FS-2002-06-068-MSFC; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Good neighborhoods help you grow. As with a city, the lives of a cell are governed by its neighborhood connections. Connections that do not work are implicated in a range of diseases. One of those connections - between prostate cancer and bone cells - will be studied on STS-107 using the Bioreactor Demonstration System (BDS-05). to improve the prospects for finding novel therapies, and to identify biomarkers that predict disease progression, scientists need tissue models that behave the same as metastatic or spreading cancer. This is one of several NASA-sponsored lines of cell science research that use the microgravity environment of orbit in an attempt to grow lifelike tissue models for health research. As cells replicate, they "self associate" to form a complex matrix of collagens, proteins, fibers, and other structures. This highly evolved microenvironment tells each cell who is next door, how it should grow and into what shapes, and how to respond to bacteria, wounds, and other stimuli. Studying these mechanisms outside the body is difficult because cells do not easily self-associate outside a natural environment. Most cell cultures produce thin, flat specimens that offer limited insight into how cells work together. Ironically, growing cell cultures in the microgravity of space produces cell assemblies that more closely resemble what is found in bodies on Earth. NASA's Bioreactor comprises a miniature life support system and a rotating vessel containing cell specimens in a nutrient medium. Orbital BDS experiments that cultured colon and prostate cancers have been highly promising.

Derived from text

*Bioreactors; Diseases; Cells (Biology); Cancer; Prostate Gland; Microgravity*

**20030011385** NASA Ames Research Center, Moffett Field, CA USA

**The Effect of Microgravity on the Smallest Space Travelers: Bacterial Physiology and Virulence on Earth and in Microgravity**

Pyle, Barry, Montana State Univ., USA; Vasques, Marilyn, NASA Ames Research Center, USA; STS 107 Shuttle Press Kit: Providing 24/7 Space Science Research; Dec. 16, 2002, pp. 38-39; In English; Also announced as 20030011376

Report No.(s): NASA/KSC-2002-057d; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Since the first human flights outside of Earth's gravity, crew health and well-being have been major concerns. Exposure to microgravity during spaceflight is known to affect the human immune response, possibly making the crew members more vulnerable to infectious disease. In addition, biological experiments previously flown in space have shown that bacteria grow faster in microgravity than they do on Earth. The ability of certain antibiotics to control bacterial infections may also differ greatly in microgravity. It is therefore critical to understand how spaceflight and microgravity affect bacterial virulence, which is their ability to cause disease. by utilizing spaceflight hardware provided by the European Space Agency (ESA), Dr. Barry Pyle and his

team at Montana State University, Bozeman, will be performing an experiment to study the effects of microgravity on the virulence of a common soil and water bacterium, *Pseudomonas aeruginosa*. Importantly, these bacteria have been detected in the water supplies of previous Space Shuttle flights. The experiment will examine the effects of microgravity exposure on bacterial growth and on the bacterium's ability to form a toxin called Exotoxin A. Another goal is to evaluate the effects of microgravity on the physiology of the bacteria by analyzing their ability to respire (produce energy), by studying the condition of the plasma membrane surrounding the cell, and by determining if specific enzymes remain active. Proteins produced by the bacteria will also be assayed to see if the normal functions of the bacteria are affected. In the context of human life support in spaceflight, the results of this experiment will offer guidance in providing the highest possible water quality for the Shuttle in order to limit the risk of infection to human occupants and to minimize water system and spacecraft deterioration.

Derived from text

*Bacteria; Infectious Diseases; Microgravity; Space Flight; Space Shuttles; Toxins and Antitoxins; Earth Gravitation*

**20030011389** NASA Kennedy Space Center, Cocoa Beach, FL USA

**Space Magnets Attracting Interest on Earth: Applications of Physical and Biological Techniques In the Study of Gravisensing and Response System of Plants**

Hasenstein, Karl H., Louisiana Univ., USA; Boody, April, NASA Kennedy Space Center, USA; STS 107 Shuttle Press Kit: Providing 24/7 Space Science Research; Dec. 16, 2002, pp. 46-47; In English; Also announced as 20030011376; Original contains color illustrations

Report No.(s): NASA/KSC-2002-057f; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The BioTube/Magnetic Field Apparatus (MFA) research is designed to provide insight into the organization and operation of the gravity sensing systems of plants and other small organisms. This experiment on STS-107 uses magnetic fields to manipulate sensory cells in plant roots, thus using magnetic fields as a tool to study gravity-related phenomena. The experiment will be located in the SPACEHAB module and is about the size of a household microwave oven. The goal of the experiment is to improve our understanding of the basic phenomenon of how plants respond to gravity. The BioTube/MFA experiment specifically examines how gravitational forces serve as a directional signal for growth in the low-gravity environment of space. As with all basic research, this study will contribute to an improved understanding of how plants grow and will have important implications for improving plant growth and productivity on Earth. In BioTube/MFA, magnetic fields will be used to determine whether the distribution of subcellular starch grains, called amyloplasts, within plant cells predicts the direction in which roots will grow and curve in microgravity.

Derived from text

*Magnetic Fields; Plants (Botany); Microgravity; Spaceborne Experiments; Space Transportation System*

**20030011391** NASA Johnson Space Center, Houston, TX USA

**Letting Our Cells Do the Fighting: Flight-Induced Changes in the Immune Response**

Pierson, Duane, NASA Johnson Space Center, USA; Bloomberg, Jacob, NASA Johnson Space Center, USA; STS 107 Shuttle Press Kit: Providing 24/7 Space Science Research; Dec. 16, 2002, pp. 50-51; In English; Also announced as 20030011376; Original contains color illustrations

Report No.(s): NASA/FS-2002-03-052-JSC; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The organisms that make us ill, such as bacteria, viruses, and fungi, are like attacking armies. We now know a great deal more about this unseen world of microscopic invaders. Fortunately for us, the human immune system is ever vigilant against them. Microorganisms such as bacteria, viruses, and fungi occupy almost every corner of the Earth, and even parts of the human body. Some organisms are beneficial to us, helping to produce milk, cheese or yogurt. Others are potentially harmful, yet we don't always develop illnesses from them; they are kept in check by the sentinels of our immune system. Our immune system is routinely challenged by these organisms every day. When the immune response is diminished, our ability to fight off these "bugs" is lowered, and that's when we become ill. Space flight presents a challenge to the immune system. Scientists believe that the stressful conditions of space flight - launch into orbit, adapting to microgravity, heavy workloads, and isolation from family and friends, to name but a few - reduce the astronauts' immunity. This immune suppression makes them more susceptible to common illnesses from bacteria and to re-infections from latent viruses in the body. In addition, risk of spreading illness in the confined environment of the Space Shuttle is high. Understanding changes in immune function will help scientists develop ways to keep astronauts healthy in space. This knowledge can also benefit earthbound populations. This experiment will give scientists insight into the immune system by comparing how certain cells of astronauts' innate immune system - the first line of defense against invaders - function after flight compared to before flight.

Author

*Physiological Responses; Immune Systems; Microgravity; Cells (Biology); Manned Space Flight*



**20030011393** NASA Johnson Space Center, Houston, TX USA

**Musing over Microbes in Microgravity: Microbial Physiology Flight Experiment**

Schweickart, Randolph, ICOS Corp., USA; McGinnis, Michael, Texas Univ., USA; Bloomberg, Jacob, NASA Johnson Space Center, USA; STS 107 Shuttle Press Kit: Providing 24/7 Space Science Research; Dec. 16, 2002, pp. 54-55; In English; Also announced as 20030011376; Original contains color illustrations

Report No.(s): NASA/FS-2002-02-061-JSC; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

New York City, the most populated city in the USA, is home to over 8 million humans. This means over 26,000 people per square mile! Imagine, though, what the view would be if you peeked into the world of microscopic organisms. Scientists estimate that a gram of soil may contain up to 1 billion of these microbes, which is as much as the entire human population of China! Scientists also know that the world of microbes is incredibly diverse-possibly 10,000 different species in one gram of soil - more than all the different types of mammals in the world. Microbes fill every niche in the world - from 20 miles below the Earth's surface to 20 miles above, and at temperatures from less than -20 C to hotter than water's boiling point. These organisms are ubiquitous because they can adapt quickly to changing environments, an effective strategy for survival. Although we may not realize it, microbes impact every aspect of our lives. Bacteria and fungi help us break down the food in our bodies, and they help clean the air and water around us. They can also cause the dark, filmy buildup on the shower curtain as well as, more seriously, illness and disease. Since humans and microbes share space on Earth, we can benefit tremendously from a better understanding of the workings and physiology of the microbes. This insight can help prevent any harmful effects on humans, on Earth and in space, as well as reap the benefits they provide. Space flight is a unique environment to study how microbes adapt to changing environmental conditions. to advance ground-based research in the field of microbiology, this STS-107 experiment will investigate how microgravity affects bacteria and fungi. of particular interest are the growth rates and how they respond to certain antimicrobial substances that will be tested; the same tests will be conducted on Earth at the same times. Comparing the results obtained in flight to those on Earth, we will be able to examine how microgravity induces physiological changes in the microbes.

Author

*Anti-infectives and Antibacterials; Bacteria; Fungi; Microgravity; Spaceborne Experiments; Growth*

**20030011407** Wisconsin Univ., Wisconsin Center for Space Automation and Robotics, Madison, WI USA

**ASTROCULTURE(tm) Commercial Plant Growth Unit and Glove Box Insert**

Zhou, Wei-Jia, Wisconsin Univ., USA; STS 107 Shuttle Press Kit: Providing 24/7 Space Science Research; Dec. 16, 2002, pp. 82-84; In English; Also announced as 20030011376; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Two commercial plant investigations will be conducted during the STS-107 mission: living flower essential oil production and gene transfer. The research will be done using the ASTROCULTURE (trademark) hardware, which builds on similar experiments flown in the past on the space shuttle. This research will investigate how microgravity might affect the formation of the volatile chemical compounds - the essential oils - produced by two different types of living flowers. The flowers will be cultured in the ASTROCULTURE (trademark) plant chamber, which provides an enclosed and controlled environment. As the flowers bloom in space, they will produce essential oils, and these volatile compounds will be collected using International Flavors and Fragrance's proprietary Solid Phase Micro Extraction (SPME) technology. The gene transfer experiment examines a newly developed transformation system to see if it operates efficiently in the microgravity environment. This research is important for the development of genetically engineered crops, also known as transgenic crops.

Author

*Spaceborne Experiments; Vegetation Growth; Microgravity; Aerospace Technology Transfer; Technology Utilization*

**20030011408** Instrumentation Technology Associates, Inc., Exton, PA USA

**Commercial Instrumentation Technology Associates Inc. Biomedical Experiments Payload (CIBX-2)**

Morrison, Dennis, NASA Johnson Space Center, USA; Edmundson, Allen, Oklahoma Medical Research Foundation, USA; STS 107 Shuttle Press Kit: Providing 24/7 Space Science Research; Dec. 16, 2002, pp. 85-87; In English; Also announced as 20030011376; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Experiments to find solutions for a range of biomedical issues are being hosted by the Commercial Instrumentation Technology Associates Inc. (ITA) Biomedical Experiments (CIBX-2) payload. This research encompasses more than 20 separate experiments including cancer research, commercial experiments and hands-on student experiments from 10 schools as part of ITA's ongoing University Among the Stars program. Protein crystal growth experiments will address the structure of urokinase - a protein that has been identified as a key enzyme in the spread of brain, lung, colon, prostate and breast cancers. Crystals of Bence Jones, a protein associated with bone cancer, will also be grown. Understanding their structures may help scientists develop treatments. In a related area, the Microencapsulation of Drugs (MEPS) is an anti-cancer drug delivery system, based on a 10-year

partnership with NASA's Johnson Space Center. On this mission, the co-encapsulation of antibodies and immune stimulants will be made in submicron microcapsules to target pulmonary and bacterial infections.

Author

*Spaceborne Experiments; Space Shuttle Payloads; Aerospace Medicine; Cancer; Aerospace Technology Transfer; Technology Utilization; Protein Crystal Growth*

**20030011419** Spacehab, Inc., USA

**STARS Student Experiments**

STS 107 Shuttle Press Kit: Providing 24/7 Space Science Research; Dec. 16, 2002, pp. 120-123; In English; Also announced as 20030011376; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

SPACEHAB's complement of commercial experiments includes six educational experiments designed and developed by students in six different countries under the auspices of Space Technology and Research Students (STARS), a global education program managed by SPACEHAB subsidiary Space Media. The student investigators who conceived these experiments will monitor their operations in space. The experiments will be housed in BioServe Space Technologies' Isothermal Containment Module (ICM --a small temperature-controlled facility that provides experiment support such as physical containment, lighting, and video imaging) and stowed in a middeck-size locker aboard the Research Double Module.

Author

*Aerospace Technology Transfer; Spaceborne Experiments; Technology Utilization; Students; Space Shuttle Payloads*

**20030011452** Visual Telecommunications Network, Inc., McLean, VA USA

**Secure Wireless Military Healthcare Telemedicine Enterprise System Annual Report, 1 Sep. 2001-31 Aug. 2002**

Lucas, Kenneth W.; Gilbert, Gary R.; Sep. 2002; 18p; In English

Contract(s)/Grant(s): DAMD17-01-2-0048

Report No.(s): AD-A408778; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The primary objective of this research effort is to integrate ViTel Net's Medvizer (TM) software and Division Tools with cross platform telemedicine systems, inclusive of computer based systems, handheld wireless PDA devices, and miniature computers, to existing DoD legacy and developing healthcare information systems, clinical repositories, and knowledge base systems for application at the point of care. This annual report reflects a number of projects wherein the tasks defined in the SOW are being accomplished. Specific project reports referenced herein detailing the specific application, work progress, and results will be submitted as supplementary reports.

DTIC

*Information Systems; Telemedicine; Radiotelephones*

**20030011453** Colorado Univ., Health Sciences Center, Denver, CO USA

**Ph.D. Post-Doctoral Training Program in Breast Cancer Research Annual Report, 1 Jul. 2001-30 Jun. 2002**

Edwards, Dean P.; Jul. 2002; 41p; In English

Contract(s)/Grant(s): DAMD17-00-1-0474

Report No.(s): AD-A408784; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The training program is designed to graduate well-qualified and highly motivated scientists who will make a career in the breast cancer research field and who will have a strong potential for contributing new research approaches to the breast cancer problem. The students accepted into the program have already entered into different Ph.D. degree granting programs that each have their own guidelines, curriculums, and requirements. The curriculum of the Breast Cancer Training Program extends beyond that of the normal Ph.D. requirements to include didactic classroom teaching, journal clubs, seminars, workshops and mini-symposiums on relevant topics in breast cancer. Additionally, the program provides extensive one-on-one laboratory training in breast cancer research that is committed to the discovery of new fundamentals about the biology of breast cancer and its eventual treatment. The faculty who serve as research mentors have established records of successful training of Ph.D. and M.D./Ph.D. students.

DTIC

*Cancer; Education; Occupation*

**20030011477** Baylor Univ., Baylor Research Inst., Dallas, TX USA

**The Role of the Immune Cell Cytoskeleton in Breast Cancer Immunity: Particular Relationship Between Actin and p38 MAP Kinase Final Report, 1 Jul. 2001-30 Jun. 2002**

Tong, Alex W.; Curiel, Tyler; Wei, Schuang; Jul. 2002; 7p; In English

Contract(s)/Grant(s): DAMD17-01-1-0479

Report No.(s): AD-A408842; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Deformation of the cytoskeleton activates intracellular signaling pathways, including those governing differentiation. Based on the observation that monocytes reverse transmigrating through endothelial cells spontaneously undergo differentiation into dendritic cells (DCs), we hypothesized that the cytoskeleton modulation could affect DC differentiation. Monocytes were cultured with granulocyte M-CSF (GM-CSF) plus IL-4 to induce differentiation into immature DCs. The microtubule stabilizer paclitaxel significantly reduced DC cd1a and CD40 without affecting CD54, CD80 and MHC class I expression. DCs differentiating in the presence of paclitaxel secreted significantly (>55%) less IL-12 and significantly (4-fold) more IL-10 compared to control DCs following LPS-induced maturation. As a result, DCs differentiating in the presence of paclitaxel induced 9-fold less T cell interferon-gamma compared to control DCs, and were inefficient at activating T cells. The microtubule destabilizer nocodazole reversed paclitaxel effects on DCs in a dose-dependent fashion, suggesting that derangements of microtubule movement and architecture were responsible for paclitaxel effects. Whereas LPS effects on differentiation are relatively irreversible, paclitaxel effects were reversible within 48 hours of paclitaxel withdrawal. Microtubules play an essential role in DC phagocytosis and migration. These data suggest that microtubules also mediate non-phagocytic DC functions including differentiation and T cell activation.

DTIC

*Cancer; Interferon; Leukocytes; Dosage*

**20030011481** Pennsylvania State Univ., Coll. of Medical, Hershey, PA USA

**Mechanism of Ras Activation by TGF $\beta$**  *Annual Report, 1 Jul. 2001-30 Jun. 2002*

Mulder, Kathleen M.; Jul. 2002; 136p; In English

Contract(s)/Grant(s): DAMD17-01-1-0592

Report No.(s): AD-A408725; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

We have shown that TGF $\beta$  regulates Has and Mapk signaling pathways. Dynein is a molecular motor protein that mediates intracellular transport of cargo along polarized microtubules (MTs) toward the minus ends. Activation of a motor may occur by several mechanisms, which can be regulated by growth factors. Thus, the receptors and signaling pathways for these polypeptides are potential mediators of motor protein activation and organelle trafficking, events which ultimately determine the collective spatial organization of the signaling pathways within the cell. Here we describe a novel TGF $\beta$  receptor-interacting protein, termed km23, which is also a dynein light chain. km23 interacts with TGF $\beta$  receptors and is phosphorylated after ligand-receptor engagement. Forced expression of km23 induces specific TGF $\beta$  responses. TGF $\beta$  induces the recruitment of km23 to the intermediate chain of dynein, which is blocked by a kinase-deficient form of TGF $\beta$  RII. This is the first demonstration of a link between dynein and a natural, growth inhibitory cytokine. Further, our results indicate km23 may function as a motor receptor for the recruitment and transport of TGF $\beta$  signaling components along MTs. Alterations in km23 would alter such transport and disrupt TGF $\beta$  growth inhibitory signals, thereby increasing the malignant behavior of the cells.

DTIC

*Cells (Biology); Cancer; Mammary Glands*

**20030011483** Texas Univ., Southwestern Medical Center, Dallas, TX USA

**Prediction of Breast Cancer Risk by Aberrant Methylation in Mammary Duct Lavage** *Annual Report, 1 Jul. 2001-30 Jun. 2002*

Virmani, Arvind K.; Jul. 2002; 35p; In English

Contract(s)/Grant(s): DAMD17-01-1-0421

Report No.(s): AD-A408741; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Ductal lavage is a minimally invasive method of collecting samples of milk duct cells. These cells hold promise in identifying women at increased risk of developing breast cancer and can be examined by cytopathology to determine whether they are normal, atypical or malignant. However, more sensitive molecular methods of detection have been developed. For example, aberrant methylation of genes by methylation-specific PCR (MSP) can identify tumor cells with a sensitivity of 1 in 1000 normal cells. Our objective is to analyze ductal lavage cells for aberrant methylation of genes that are frequently methylated in breast cancers but not in normal breast tissues. We have collected ductal lavage samples from 50 women. Twenty four women (48%) had breast cancer while 26 women (52%) were identified at varying degrees of increased risk for developing breast cancer based on computerized modeling. The samples were examined by cytopathology. We performed MSP analysis for 15 genes in breast cancer cell lines / primary tumors. Of these, we have identified five genes namely APC, Cyclin D2, RAR $\beta$ , RASSF1A and TMS1, that

are frequently methylated in tumors. Methylation analysis of these genes will be performed in breast ductal cells and will be correlated with cytological findings.

DTIC

*Mammary Glands; Methylation; Cancer*

**20030011491** Seattle Univ., WA USA

**Factors Affecting African American Women's Participation in Breast Cancer Screening Programs: A Qualitative Study of Uninsured Low Income Women** *Annual Report, 10 Jul. 2001-9 Jul 2002*

Lewis, Frances M.; Phillips-Angles, Ellen; Song, Lin; Aug. 2002; 46p; In English

Contract(s)/Grant(s): DAMD17-00-1-0493

Report No.(s): AD-A408774; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The purpose of the current study is to elaborate the beliefs and culturally embedded meanings that a population of low income, uninsured African American women held toward breast cancer and breast cancer screening. During Year 02, we conducted technical analyses of completed Phase 1 interviews that were obtained from African American women who were eligible to receive, but who chose to decline, free screening mammograms. Results obtained to date suggest that screening mammograms are physically and emotionally difficult experiences for the women, not neutral procedures for detecting early disease. Women equate mammograms with disease, not with merely early detection. For some, mammograms cause disease and put them at higher risk because of radiation exposure. Early diagnosis and treatment for many do not equate with cure, but with inevitable disease progression. Risk factors for breast cancer were not well understood and some women generated a unique set of risk factors that have no prior evidence in research literature, e.g., having large breasts. Having breast cancer means losses, deformity, remaining single, altered sexual behavior with a partner, and burdening one's family. There is little evidence of hope for cure in the interview data nor for surviving the diagnosis of breast cancer, even when detected early. Results to date have substantial implication for developing new outreach and educational messages.

DTIC

*Cancer; Risk; Radiation Dosage; Detection; Diseases*

**20030011492** Strang Cancer Prevention Center, New York, NY USA

**Cox Model for Interval Censored Data in Breast Cancer Follow-Up Studies** *Annual Report, 1 Jul. 2001-30 Jun. 2002*

Wong, George Y.; Jul. 2002; 10p; In English

Contract(s)/Grant(s): DAMD17-00-1-0448

Report No.(s): AD-A408771; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The overall objective of this research proposal is semi-parametric inference of the Cox regression model for a survival function  $\Pr(X \text{ is greater than } x/Z=z) = S(x/z) = S_0(x) e^{z\beta}$ , where  $X$  is subject to interval censoring,  $Z$  represents the covariates,  $S_0$  is a baseline survival function, and  $\beta$  represents the regression coefficients. One objective of our research is to develop asymptotic inference of the generalized maximum likelihood estimator (GMLE) of the regression coefficients  $\beta$  and  $S_0(\cdot/z)$ .

DTIC

*Cancer; Censored Data (Mathematics)*

**20030011495** Cold Spring Harbor Lab., New York, NY USA

**Analysis of Apaf-1 and Caspase 9 in Tumorigenesis** *Annual Report, 1 Jul. 2001-30 Jun. 2002*

Narita, Masashi; Jul. 2002; 27p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-01-1-0209

Report No.(s): AD-A408766; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

My long-term goal is to identify new components of tumor suppressor networks that are important in breast cancer. My initial proposal focused on apoptosis, and how components of the apoptotic machinery influence breast carcinogenesis and chemotherapeutic responses. For several reasons, these studies were abandoned to focus on cellular senescence. Senescence is a permanent cell cycle arrest program that is conceptually similar to apoptosis and is controlled by the p53, p16, and Rb tumor suppressors (which are important in breast carcinogenesis). I am currently identifying components of the senescence machinery and determining how they suppress proliferation. I have shown that senescence is accompanied by changes in chromatin structure that depend on the p16/Rb tumor suppressor pathway and lead to the repression of growth regulatory genes. I have also generated chimeric mice harboring ES cells with a targeted disruption of one putative component of the silencing program. Future studies will examine the impact of these mechanisms on transformation in vitro and tumorigenesis in vivo, as well as their ability to



modulate the cytotoxicity of anticancer drugs. These studies are guided by our understanding of apoptosis, and promise to provide new insights into a new program of tumor suppression in breast cancer.

DTIC

*Cancer; Tumors; Aging (Biology); Carcinogens*

**20030011500** Colorado Univ., Health Sciences Center, Aurora, CO USA

**Sixth Phantom Users Group Conference Final Report, 1 Sep. 2001-31 Dec. 2002**

Reinig, Karl D.; Jan. 2002; 141p; In English; Original contains color images

Contract(s)/Grant(s): DAMD17-01-0828

Report No.(s): AD-A408752; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This grant represented the major funding for the Sixth PHANTOM Users Group Conference. The conference was held in a workshop style at the Given Institute in Aspen Colorado. This was the second time that the University of Colorado hosted the conference. The conference successfully attracted haptic researchers from around the world. In addition to the individual papers, the conference included a discussion of haptic standards and multiple tutorials.

DTIC

*Computerized Simulation; Clinical Medicine; Research Management; Applications Programs (Computers); Human-Computer Interface; Aerospace Medicine*

**20030011519** Loma Linda Veterans Association for Research and Education, Loma Linda, CA USA

**Molecular Mechanisms of Soft Tissue Regeneration and Bone Formation in Mice: Implications in Fracture Repair and Wound Healing in Humans Annual Report, 1 Oct. 2001-30 Sep. 2002**

Baylink, David J.; Oct. 2002; 54p; In English

Contract(s)/Grant(s): DAMD17-99-1-9571

Report No.(s): AD-A408806; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The primary goal of the proposed work is to identify genes which play an anabolic role in bone and soft tissue function and to clarify the function of these genes. Three hypotheses have been proposed: 1) the high bone density gene in chromosome 1 in our CAST/B6 congenic mice can be clones; 2) Genes that regulate soft-and hard-tissue regeneration can be identified by using appropriate mouse strains that exhibit differences in regeneration; and 3) ENU mutagenesis, applied to our mouse model, will lead to the identity of genes that regulate soft and hard tissue function. During the last funding period, we have proposed several specific objectives for each of the above mentioned hypothesis. As disclosed in the progress report, we have successfully accomplished all of the specific objectives. Our work during this reporting period has resulted in three published manuscripts, one manuscript in press, one submitted manuscript, one manuscript under revision for publication, and two abstracts. We believe that successful accomplishment of the proposed studies will provide a better understanding of the molecular mechanisms involved in hard- and soft-tissue regeneration and will provide a framework for future development of therapies for hard and soft tissue injuries.

DTIC

*Bones; Healing; Chromosomes; Mutagenesis*

**20030011521** Minnesota Univ., Natural Resources Research Inst., Duluth, MN USA

**Prediction of Human Blood: Air Partition Coefficient: A Comparison of Structure-Based and Property-Based Methods Final Report, 15 Dec. 2000-14 Dec 2002**

Basak, Subhash C.; Mills, D.; Hawkins, D. M.; El-Masri, H. A.; Oct. 15, 2002; 18p; In English; Prepared in cooperation with Computational Toxicology Lab, Div. of Toxicology Agency for Toxic Substances and Disease Registry (ATSDR), Atlanta, GA Contract(s)/Grant(s): F49620-01-1-0098; AF Proj. 2312

Report No.(s): AD-A408827; AFRL-SR-AR-TR-02-0359; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In recent years, there has been increased interest in the development and use of quantitative structure activity/property relationship (QSAR/QSPR) models. For the most part, this is due to the fact that experimental data is sparse and obtaining such data is costly, while theoretical structural descriptors can be obtained quickly and inexpensively. In this study, three linear regression methods, viz, principal component regression (PCR), partial least squares (PLS), and ridge regression (RR) were used to develop QSPR models for the estimation of human blood; air partition coefficient (logP blood;air) for a group of 31 diverse low-molecular weight volatile chemicals from their computed molecular descriptors. In general, RR was found to be superior to PCR or PLS. Comparisons were made between models developed using parameters based solely on molecular structure and linear regression (LR) models developed using experimental properties, including saline;air partition coefficient (logP saline;air) and olive oil;air partition coefficient (logP olive oil;air), as independent variables, indicating that the structure-property correlations are comparable to the property-property correlations. The best models, however, were those which used rat logP blood;air as the

independent variable. Haloalkane subgroups were modeled separately for comparative purposes, and although models based on the congeneric compounds were superior, the models developed on the complete set of diverse compounds were of acceptable quality. The structural descriptors were superior, the models developed on the complete set of diverse compounds were of acceptable quality.

DTIC

*Predictions; Toxicology; Low Molecular Weights; Molecular Structure; Blood*

**20030011524** Cold Spring Harbor Lab., New York, NY USA

**Isolation of Genes in Rac Induced Invasion and Metastasis of Breast Carcinoma Cells** *Final Report, 1 Jul. 1999-1 Jul 2002*

Aelst, Linda Van; Aug. 2002; 88p; In English

Contract(s)/Grant(s): DAMD17-99-1-9139

Report No.(s): AD-A408834; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

A better understanding of the progression of a primary breast tumor to its metastatic state is crucial to develop more direct forms of screenings and therapy. Members of the Rho GTPases, in particular Rac1, play important roles in cellular processes implicated in tumor progression, such as proliferation, adhesion and invasion. to identify target genes of RacI which mediate its effects on the above processes, we applied cDNA-RDA and microarray analyses. These experiments resulted in the identification of 85 independent gene fragments (among them 23 novel genes) which showed altered expression levels as a result of RacIV12 and RacIN17 expression. The difference in mRNA abundance of twenty genes has been reconfirmed by northern blot analysis. Among them are previously identified genes associated with tumorigenesis and/or invasion, such as cyclin D1, COX-2, CDO, ICAP1 and NF-kappa B. We focussed our efforts on the characterization of cyclin D1, COX-2 and more recently ICAP1 with respect to mediating RacIV12 effect on cell proliferation and invasion. We obtained evidence supporting a role for COX-2 in RacIV12-triggered increase in cell growth. The further characterization of the other cDNAs is likely to identify additional relevant RacI targets and is presently ongoing.

DTIC

*Diagnosis; Metastasis; Mammary Glands; Cancer; Genes*

**20030011526** California Univ., Los Angeles, CA USA

**Peptide Antiestrogens for Human Breast Cancer Therapy** *Final Report, 1 Jul. 1999-30 Jun. 2002*

Pietras, Richard J.; Jul. 2002; 65p; In English

Contract(s)/Grant(s): DAMD17-99-1-9099

Report No.(s): AD-A408843; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Estrogen binds specific receptors present in 70% of breast cancers. Estrogen receptor (ER) is a phosphoprotein that regulates transcription and growth by binding estrogen response elements (ERE) in DNA. Inactive ER is a monomer that forms dimers on estrogen-induced phosphorylation ER transcriptional activity is regulated by distinct conformational states resulting from ligand binding, and the induced complex recruits steroid receptor coactivator proteins, such as SRC-1, that are essential for growth. Peptides modeled from interacting sites of ER may selectively inhibit ER signals and act as antiestrogens. to test this hypothesis, we made small peptides to mimic highly conserved ER sequence at tyrosine-537 and surrounding leucine residues. Peptide antiestrogens, but not control peptides, block ER association with SRC-1 and disrupt binding of ER to ERR. In vitro studies, estradiol stimulates breast cell growth, and this estrogen effect is blocked by peptide antiestrogens conjugated with Antennapedia carrier, but not controls. Using in vivo tumor xenografts, treatment with peptide antiestrogens shows significant activity in arresting growth of estrogen-dependent breast tumors. This work provides target validation but also shows that peptide drugs are difficult to administer. Thus, we have prepared more lipid-like, peptidomimetic derivatives that function similarly but may be easier to use in the clinic.

DTIC

*Peptides; Estrogens; Cancer; Therapy; Proteins*

**20030011536** Beth Israel Deaconess Medical Center, Boston, MA USA

**Designer T Cells for Breast Cancer Therapy: Phase I Studies** *Final Report, 1 Jul. 1998-30 Jun. 2002*

Junghans, Richard P.; Jul. 2002; 10p; In English

Contract(s)/Grant(s): DAMD17-98-1-8284

Report No.(s): AD-A408881; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

In the present report we describe studies using chimeric immune receptors consisting of an antibody fragment against the CEA tumor antigen joined to signaling portions of the T cell receptor (IgTCR). The antibody fragment confers CEA specificity to the receptor, while the signaling domains transmit T cell activation signals. These receptors allow the T cells (designer T cells) to

bypass immune tolerance to CEA and to activate effector functions in a tumor specific manner. We have partially completed a phase I study using IgTCR-modified designer T cells. These studies demonstrate the specific signaling molecules activate specific T cell effector functions in a tumor specific manner. The study will be completed on a continuing no-cost extension with the funds allocated.

DTIC

*Lymphocytes; Antigens; Mammary Glands; Cancer*

**20030011543** Texas Univ., Southwestern Medical Center, Dallas, TX USA

**Do Telomerase Inhibitors Prevent the Spontaneous Immortalization of Breast Epithelial Cells from Individuals Predisposed to Breast Cancer? Annual Report, 1 Jul. 2001-30 Jun. 2002**

Herbert, Brittney-Shea; Shay, Jerry W.; Jul. 2002; 24p; In English

Contract(s)/Grant(s): DAMD17-00-1-0438

Report No.(s): AD-A408915; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The activity of telomerase has been shown to be absent in normal somatic cells, with the exception of stem cells. The reactivation of telomerase has been seen as an early event in most cancers, especially breast cancer. I have previously shown that the inhibition of telomerase led to the inhibition of cell growth via telomere-based mechanisms. During the second year, to understand the mechanism of telomere shortening and growth inhibition, microarray analyses were performed to detect changes in the transcriptional profiling. Also during the second year, another type of telomerase inhibitor, oligonucleotide phosphoramidates, was shown to be an efficient telomerase inhibitor and potential therapeutic agent. Furthermore, I previously showed that telomerase inhibitors and tamoxifen could prevent the spontaneous immortalization of Li-Fraumeni Syndrome-derived breast epithelial cells. During the second year, microarray analyses detected changes in the transcriptional profiling after treatment. Also, preliminary Northern analyses of the spontaneously immortalized breast epithelial cells showed that while the cells were negative for estrogen receptor-alpha (ER $\alpha$ ) by histology, the data show that the cells possibly contain ER $\alpha$ . Tamoxifen mechanism may be to utilize orphan receptors. These studies should lead to new insights in preventing the occurrence or recurrence of breast cancer.

DTIC

*Mammary Glands; Cancer; Enzymes*

**20030011564** Pennsylvania State Univ., College of Medicine, Hershey, PA USA

**Understanding the Mechanism of Action of Breast Metastasis Suppressor BRMS1 Annual Report**

Semant, Rajeev S.; Jul. 2002; 29p; In English

Contract(s)/Grant(s): DAMD17-01-1-0362

Report No.(s): AD-A408646; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The focus of this study is to understand the biology behind the metastasis suppression via BRMS1, a recently identified metastasis suppressor gene. BRMS1 is a protein with a glutamic acid rich N-terminus, coiled-coil domain, an imperfect leucine zipper and nuclear localization signals. It is expressed almost ubiquitously in human tissues and is highly conserved across species. Sub-cellular fractionation and fluorescence immuno-cytochemistry has indicated that it localizes to nucleus. BRMS1 is shown to restore homotypic gap-junctional communication. Our hypothesis is that it may be involved in transcription regulatory complex. To identify proteins that interacting with BRMS1 a yeast two-hybrid screen was performed using full length BRMS1 as a bait and human mammary gland library as a prey. Eight genetic interactors of BRMS1 were identified. These are MRJ (Hsj40 related chaperon), CCG1 (a protein essential for progression of G phase), SMTN (cytoskeletal protein specific to smooth muscles), FLJ00052 (EST), KPNA5 (karyopherin alpha 5), Nmi (N-myc interactor), BAF 57 (BRG1 associated factor) and RBP1 (Rb binding protein). The BRMS1 and RBP1 as well as BRMS1 and MRJ 1 interactions were further confirmed at cellular level by co-immunoprecipitation studies. Currently we are exploring the relevance of this interaction with respect to metastasis and cell cycle.

DTIC

*Mammary Glands; Metastasis; Suppressors; Immunology; Genetics; Cancer; Cytology*

52  
**AEROSPACE MEDICINE**

*Includes the biological and physiological effects of atmospheric and space flight (weightlessness, space radiation, acceleration, and altitude stress) on the human being; and the prevention of adverse effects on those environments. For psychological and behavioral effects of aerospace environments see 53 Behavioral Science. For the effects of space on animals and plants see 51 Life Sciences.*

**20030007781** National Inst. of Health, Office of Research on Women's Health, Bethesda, MD USA

**Report of the Advisory Committee on Research on Women's Health: Office of Research on Women's Health and NIH Support for Research on Women's Health Issues, FY 1999 - 2000**

2002; 422p; In English

Report No.(s): PB2003-100832; NIH/PUB-02-4952; No Copyright; Avail: CASI; A18, Hardcopy; A04, Microfiche

The Advisory Committee on Research on Women's Health (ACRWH), in concert with the Office of Research on Women's Health (ORWH) and the National Institutes of Health (NIH) Coordinating Committee on Research on Women's Health (CCRWH), provides the Director of the National Institutes of Health with a biennial report describing the comprehensive and coordinated efforts of ORWH and NIH institutes and centers to address women's health issues through research and related activities. This volume describes such activities supported in FY 1999 and 2000. This report also provides information concerning levels of support for research related to women's health and ancillary activities. The ACRWH believes that this report accurately reflects the breadth and depth of research and related activities through which NIH is fulfilling its mandate from the U.S. Congress to address women's health issues and women's inclusion in research.

NTIS

*Females; Clinical Medicine; Research Management; Human Body; Health*

**20030010457** Army Research Inst. of Environmental Medicine, Military Performance Div., Natick, MA USA

**The Effect of Backpack Moment of Inertia on Transverse Plane Kinetics and Kinematics and Oxygen Consumption During Walking**

LaFiandra, M. E.; Holt, K. G.; Wagenaar, R. C.; Obusek, J. P.; Oct. 2002; 28p; In English

Report No.(s): AD-A408671; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The purpose of this experiment was to investigate the effects of systematically manipulating the transverse plane moment of inertia (MOI) of the upper body on upper body torque, lower body torque, the phase relationship between the upper and lower body, and oxygen consumption. It was hypothesized that increasing the MOI of the upper body would result in (1) an increase in upper body torque that would be less than predicted solely from the increase in upper body MOI, (2) a decrease in lowerbody torque, (3) a more in-phase pattern of pelvic and thoracic rotation and, (4) an increase in oxygen consumption. Eleven subjects (4 male, 7 female, mean age: yr+SE 26+2.0) walked on a treadmill at 1.3 ms-i without a load and with an adjustablebackpack containing a load that was 40% of their body mass. Seven backpack MOI conditions were achieved by sliding two metalplates along a metal bar away from the transverse plane trunk axis of rotation. In the backpack condition with the smallest MOI, the predicted upper body torque was 1.6 times greater than the actual upper body torque, while in the largest backpack MOI condition, predicted upper body torque was 2.75 times greater than the actual. Increasing the MOI of the backpack resulted in no statistically significant change in lower body torque or oxygen consumption and a significantly more out-of-phase pattern of pelvic and thoracic rotation. We concluded that increasing the MOI of the backpack increases the reluctance of the upper body to changes in rotational movement. Consequently, changes in lower body torque and trunk coordination have less influence on upper body torque, and there is a releasing of movement degrees of freedom in the lower body.

DTIC

*Physiological Effects; Kinematics; Kinetics; Moments of Inertia; Oxygen Consumption; Walking*

**20030011386** NASA Ames Research Center, Moffett Field, CA USA

**Understanding How Astronauts Adapt to Space and to Earth: Anatomical Studies of Central Vestibular Adaptation**

Holstein, Gay, Mount Sinai School of Medicine, USA; Vasques, Marilyn, NASA Ames Research Center, USA; STS 107 Shuttle Press Kit: Providing 24/7 Space Science Research; Dec. 16, 2002, pp. 40-41; In English; Also announced as 20030011376; Original contains color illustrations

Report No.(s): NASA/JSC-2002-057c; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Significant changes take place in the nervous systems of astronauts during and following exposure to microgravity. These changes, particularly in the part of the brain that controls balance, the vestibular system, can cause sensations of rotation, dizziness, and vertigo, as well as space adaptation syndrome. Adaptation to the microgravity environment usually occurs within one week, and a subsequent re-adaptation period of several days is often required upon return to Earth. In order to realize long-term



spaceflight, effective countermeasures for these symptoms must be developed. The structural changes that take place in one of the vestibular regions of the brain (the cerebellar cortex) during the process of adaptation to Earth's gravity remain unclear and are the subject of an experiment being conducted on STS-107 by Dr. Gay Holstein of the Mount Sinai School of Medicine in New York. Using the rat as a model, Dr. Holstein and her team will seek to identify the cellular changes underlying the vestibular changes experienced by astronauts.

Author

*Astronauts; Microgravity; Space Adaptation Syndrome; Space Transportation System; Manned Space Flight; Vestibular Tests; Earth Gravitation*

**20030011387** NASA Ames Research Center, Moffett Field, CA USA

**Understanding How Space Travel Affects Blood Vessels: Arterial Remodeling and Functional Adaptations Induced by Microgravity**

Delp, Michael, Texas A&M Univ., USA; Vasques, Marilyn, NASA Ames Research Center, USA; STS 107 Shuttle Press Kit: Providing 24/7 Space Science Research; Dec. 16, 2002, pp. 42-43; In English; Also announced as 20030011376; Original contains color illustrations

Report No.(s): NASA/KSC-2002-057a; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Ever rise quickly from the couch to get something from the kitchen and suddenly feel dizzy? With a low heart rate and relaxed muscles, the cardiovascular system does not immediately provide the resistance necessary to keep enough blood going to your head. Gravity wins, at least for a short time, before your heart and blood vessels can respond to the sudden change in position and correct the situation. Actually, the human cardiovascular system is quite well adapted to the constant gravitational force of the Earth. When standing, vessels in the legs constrict to prevent blood from collecting in the lower extremities. In the space environment, the usual head-to-foot blood pressure and tissue fluid gradients that exist during the upright posture on Earth are removed. The subsequent shift in fluids from the lower to the upper portions of the body triggers adaptations within the cardiovascular system to accommodate the new pressure and fluid gradients. In animal models that simulate microgravity, the vessels in the head become more robust while those in the lower limbs become thin and lax. Similar changes may also occur in humans during spaceflight and while these adaptations are appropriate for a microgravity environment, they can cause problems when the astronauts return to Earth or perhaps another planet. Astronauts often develop orthostatic intolerance which means they become dizzy or faint when standing upright. This dizziness can persist for a number of days making routine activities difficult. In an effort to understand the physiological details of these cardiovascular adaptations, Dr. Michael Delp at Texas A&M University, uses the rat as a model for his studies. For the experiment flown on STS-107, he will test the hypothesis that blood vessels in the rats' hindlimbs become thinner, weaker, and constrict less in response to pressure changes and to chemical signals when exposed to microgravity. In addition, he will test the hypothesis that arteries in the brain become thicker as a result of microgravity-induced fluid shifts toward the head.

Author

*Aerospace Environments; Blood Vessels; Cardiovascular System; Microgravity; Tolerances (Physiology); Spaceborne Experiments*

**20030011388** NASA Ames Research Center, Moffett Field, CA USA

**Understanding Fluid Shifts in the Brain: Choroidal Regulation Involved in the Cerebral Fluid Response to Altered Gravity**

Gabrion, Jaqueline, Paris VI Univ., France; Vasques, Marilyn, NASA Ames Research Center, USA; STS 107 Shuttle Press Kit: Providing 24/7 Space Science Research; Dec. 16, 2002, pp. 44-45; In English; Also announced as 20030011376

Report No.(s): NASA/KSC-2002-057b; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Fluid balance and regulation of body fluid production are critical aspects of life and survival on Earth. In space, without gravity exerting its usual downward pulling effect, the fluids of the human body shift in an unnatural, headward direction. After awhile, humans and other mammalian species adapt to the microgravity environment which leads to changes in the regulation and distribution of these body fluids. Previous spaceflight experiments have indicated that production of fluid in the brain and spinal cord, cerebrospinal fluid (CSF), might be reduced in rats exposed to microgravity. In this experiment conducted by Dr. Jacqueline Gabrion (University of Pierre and Marie Curie, France), proteins important for CSF production, and several molecules that regulate water and mineral transport, will be investigated in rats flown on the Shuttle. Dr. Gabrion and her team will determine the amounts of these proteins and molecules present in the brain in order to evaluate whether any changes have taken place during the rats' adaptation to microgravity. The levels of different aquaporins (proteins that act as a channel for water transport in and out of cells) will also be investigated in other areas of the brain and body to better understand the regulatory responses affecting these important water channel proteins. In addition to producing essential and basic information about fluid production in the brain

and body, this experiment will reveal fundamental information about the mechanisms involved in cerebral adaptation and fluid balance during spaceflight.

Author

*Body Fluids; Brain; Cerebrum; Spaceborne Experiments; Microgravity; Regulatory Mechanisms (Biology)*

**20030011390** NASA Johnson Space Center, Houston, TX USA

**From Milk to Bones, Moving Calcium Through the Body: Calcium Kinetics During Space Flight**

Smith, Scott, NASA Johnson Space Center, USA; Bloomberg, Jacob, NASA Johnson Space Center, USA; STS 107 Shuttle Press Kit: Providing 24/7 Space Science Research; Dec. 16, 2002, pp. 48-49; In English; Also announced as 20030011376; Original contains color illustrations

Report No.(s): NASA/FS-2002-03-051-JSC; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Did you know that when astronauts are in space, their height increases about two inches? This happens because the weightlessness of space allows the spine, usually compressed in Earth's gravity, to expand. While this change is relatively harmless, other more serious things can happen with extended stays in weightlessness, notably bone loss. From previous experiments, scientists have observed that astronauts lose bone mass at a rate of about one percent per month during flight. Scientists know that bone is a dynamic tissue - continually being made and repaired by specialized bone cells throughout life. Certain cells produce new bone, while other cells are responsible for removing and replacing old bone. Research on the mechanisms of bone metabolism and the effects of space flight on its formation and repair are part of the exciting studies that will be performed during STS-107. Calcium plays a central role because 1) it gives strength and structure to bone and 2) all types of cells require it to function normally. Ninety-nine percent of calcium in the body is stored in the skeleton. However, calcium may be released, or resorbed, from bone to provide for other tissues when you are not eating. To better understand how and why weightlessness induces bone loss, astronauts will participate in a study of calcium kinetics - that is, the movement of calcium through the body, including absorption from food, and its role in the formation and breakdown of bone.

Author

*Bone Demineralization; Calcium; Kinetics; Musculoskeletal System; Microgravity; Manned Space Flight*

**20030011392** NASA Johnson Space Center, Houston, TX USA

**Maintaining the Body's Immune System: Incidence of Latent Virus Shedding During Space Flight**

Pierson, Duane, NASA Johnson Space Center, USA; Bloomberg, Jacob, NASA Johnson Space Center, USA; STS 107 Shuttle Press Kit: Providing 24/7 Space Science Research; Dec. 16, 2002, pp. 52-53; In English; Also announced as 20030011376; Original contains color illustrations

Report No.(s): NASA/FS-2002-03-048-JSC; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Your body protects you from illness with its own security system - the immune system. This system keeps illness at bay not only by mounting a defense against foreign organisms, but also by controlling the population of bacteria and viruses that normally live in your body. But there's no need to panic: certain microbes can actually exist in your body without causing illness. Some bacteria are even beneficial - like the E. coli in the large intestine that are an important source of vitamin K. While viruses are not exactly considered beneficial, they can also inhabit the human body without causing immediate harm or infection. A good example is the herpes simplex virus type 1 (HSV1), more commonly known as cold sores or fever blisters. This virus infects 70 to 80 percent of all adults but remains latent much of the time. While latent, the virus within cells remains dormant. Activation of the dormant virus causes it to make copies of itself (known as replication) constantly detectable in body fluids such as urine or saliva in a process called shedding. When a person becomes sick or stressed, however, this weakened condition allows the virus to reactivate and multiply. These elevated levels may be enough to produce symptoms, but shedding can also occur without symptoms. This ability to shed without showing signs of infection, or asymptomatic shedding, is of great interest, as it increases the chances of infecting others. The stresses associated with space flight - adapting to microgravity, isolation from family and friends, living and working in a confined space, sleep deprivation, and busy schedules, to name but a few - may weaken astronauts' immune systems, leaving them at greater risk of viral reactivation. Members of the STS-107 crew will participate in this experiment, Incidence of Latent Viral Shedding in Space Flight, to help scientists understand how reactivation works in space, and at what level replication reaches before symptoms begin to show. This study also promises more insight into the behavior of the larger virus family, herpesvirus, which will help us understand how to prevent infection in populations on Earth and reactivation in those already infected.

Author

*Microgravity; Immune Systems; Viral Diseases; Human Body; Spaceborne Experiments*

**20030011394** NASA Johnson Space Center, Houston, TX USA

**Building Muscles, Keeping Muscles: Protein Turnover During Space Flight**

Ferrando, Arny, Texas Univ., USA; Bloomberg, Jacob, NASA Johnson Space Center, USA; STS 107 Shuttle Press Kit: Providing 24/7 Space Science Research; Dec. 16, 2002, pp. 56-57; In English; Also announced as 20030011376; Original contains color illustrations

Report No.(s): NASA/FS-2002-03-053-JSC; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

As we age we lose muscle mass and strength. The problem is a matter of use it or lose it and more - a fact to which any active senior can attest. An imbalance in the natural cycle of protein turnover may be a contributing factor to decreased muscle mass. But the answer is not so simple, since aging is associated with changes in hormones, activity levels, nutrition, and often, disease. The human body constantly uses amino acids to build muscle protein, which then breaks down and must be replaced. When protein turnover gets out of balance, so that more protein breaks down than the body can replace, the result is muscle loss. This is not just the bane of aging, however. Severely burned people may have difficulty building new muscle long after the burned skin has been repaired. Answers to why we lose muscle mass and strength - and how doctors can fix it - may come from space. Astronauts usually eat a well-balanced diet and maintain an exercise routine to stay in top health. During long-duration flight, they exercise regularly to reduce the muscle loss that results from being in a near-weightless environment. Despite these precautions, astronauts lose muscle mass and strength during most missions. They quickly recover after returning to Earth - this is a temporary condition in an otherwise healthy population. Members of the STS-107 crew are participating in a study of the effects of space flight, hormone levels, and stress on protein turnover. When we are under stress, the body responds with a change in hormone levels. Researchers hypothesize that this stress-induced change in hormones along with the near-weightlessness might result in the body synthesizing less muscle protein, causing muscles to lose their strength and size. Astronauts, who must perform numerous duties in a confined and unusual environment, experience some stress during their flight, making them excellent candidates for testing the researchers' hypothesis.

Author

*Human Body; Muscles; Proteins; Physical Exercise; Spaceborne Experiments*

**20030011395** NASA Johnson Space Center, Houston, TX USA

**Protecting Space Travelers from Kidney Stones: Renal Stone Risk During Space Flight**

Whitson, Peggy, NASA Johnson Space Center, USA; Bloomberg, Jacob, NASA Johnson Space Center, USA; STS 107 Shuttle Press Kit: Providing 24/7 Space Science Research; Dec. 16, 2002, pp. 58-59; In English; Also announced as 20030011376; Original contains color illustrations

Report No.(s): NASA/FS-2002-03-049-JSC; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Renal stones, popularly known as kidney or bladder stones, are small rock-like objects formed in the kidneys or urinary tract by deposits of calcium and other minerals. The problem arises when the stones block the drainage of the kidney, resulting in urinary obstruction and pain. Passing these stones can be one of the most painful experiences a person will endure so doctors often prescribe pain relievers to ease the experience. Drinking plenty of fluids, which help flush waste out of the body, and eating a well-balanced diet are the first steps to preventing stones. For individuals at risk, this may not be enough, and a doctor may recommend a special diet and medications. Unfortunately, approximately 60 percent of people who have had a renal stone will experience a recurrence. This is particularly true of men, who are four to five times more likely to develop stones than women. Renal stones do not discriminate based on age; even children are at risk. Astronauts are particularly at risk of developing renal stones because they lose bone and muscle mass; calcium, other minerals, and protein normally used for bone and muscle end up in the bloodstream and then in the kidneys. Without plenty of fluid to wash them away, crystals can form and then grow into stones. This factor compounds the risk for astronauts, since they also perceive that they are less thirsty in space and will drink less than normal during the mission. To minimize all of these factors, doctors must instead treat the stone-forming compounds with medication. This study will use potassium citrate to reduce the risk of stone formation. Renal stones are never convenient, but they are a particular concern for astronauts who have limited access to treatment during flight. Researchers are examining how earthbound preventions for renal stone formation work in flight, ensuring missions are not ended prematurely due to this medical condition. During STS-107, earthbound preventions and treatments become astronauts' gain.

Author

*Astronauts; Kidneys; Calculi; Spaceborne Experiments*

**20030011396** NASA Johnson Space Center, Houston, TX USA

**Astronauts Need Their Rest Too: Sleep-Wake Actigraphy and Light Exposure During Space Flight**

Czeisler, Charles, Brigham and Women's Hospital, USA; Bloomberg, Jacob, NASA Johnson Space Center, USA; STS 107 Shuttle Press Kit: Providing 24/7 Space Science Research; Dec. 16, 2002, pp. 60-61; In English; Also announced as 20030011376; Original contains color illustrations

Report No.(s): NASA/FS-2002-04-059-JSC; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The success and effectiveness of human space flight depends on astronauts' ability to maintain a high level of cognitive performance and vigilance. This alert state ensures the proper operation of sophisticated instrumentation. An important way for humans to remedy fatigue and maintain alertness is to get plenty of rest. Astronauts, however, commonly experience difficulty sleeping while in space. During flight, they may also experience disruption of the body's circadian rhythm - the natural phases the body goes through every day as we oscillate between states of high activity during the waking day and recuperation, rest, and repair during nighttime sleep. Both of these factors are associated with impairment of alertness and performance, which could have important consequences during a mission in space. The human body was designed to sleep at night and be alert and active during the day. We receive these cues from the time of day or amount of light, such as the rising or setting of the sun. However, in the environment of the Space Shuttle or the International Space Station where light levels are highly variable, the characteristics of a 24-hour light/dark cycle are not present to cue the astronauts' bodies about what time of the day it is. Astronauts orbiting Earth see a sunset and sunrise every 90 minutes, sending potentially disruptive signals to the area of the brain that regulates sleep. On STS-107, researchers will measure sleep-wake activity with state-of-the-art technology to quantify how much sleep astronauts obtain in space. Because light is the most powerful time cue to the body's circadian system, individual light exposure patterns of the astronauts will also be monitored to determine if light exposure is associated with sleep disruption. The results of this research could lead to the development of a new treatment for sleep disturbances, enabling crewmembers to avoid the decrements in alertness and performance due to sleep deprivation. What we learn about sleep in space informs treatment for earthbound populations, such as the elderly and insomniacs, who experience frequent sleep disturbances or altered sleep patterns.

Author

*Activity Cycles (Biology); Astronauts; Sleep; Spaceborne Experiments*

**20030011415** European Space Agency

**Exploring Heart and Lung Function in Space: ARMS Experiments**

Kuipers, Andre, European Space Agency; Cork, Michael, European Space Agency; LeGouic, Marine, European Space Agency; STS 107 Shuttle Press Kit: Providing 24/7 Space Science Research; Dec. 16, 2002, pp. 100-101; In English; Also announced as 20030011376; Original contains color illustrations

Report No.(s): NASA/FS-2002-03-054-JSC; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The Advanced Respiratory Monitoring System (ARMS) is a suite of monitoring instruments and supplies used to study the heart, lungs, and metabolism. Many experiments sponsored by the European Space Agency (ESA) will be conducted using ARMS during STS-107. The near-weightless environment of space causes the body to undergo many physiological adaptations, and the regulation of blood pressure is no exception. Astronauts also experience a decrease in blood volume as an adaptation to microgravity. Reduced blood volume may not provide enough blood pressure to the head during entry or landing. As a result, astronauts often experience light-headedness, and sometimes even fainting, when they stand shortly after returning to Earth. To help regulate blood pressure and heart rate, baroreceptors, sensors located in artery walls in the neck and near the heart, control blood pressure by sending information to the brain and ensuring blood flow to organs. These mechanisms work properly in Earth's gravity but must adapt in the microgravity environment of space. However, upon return to Earth during entry and landing, the cardiovascular system must readjust itself to gravity, which can cause fluctuation in the control of blood pressure and heart rate. Although the system recovers in hours or days, these occurrences are not easily predicted or understood - a puzzle investigators will study with the ARMS equipment. In space, researchers can focus on aspects of the cardiovascular system normally masked by gravity. The STS-107 experiments using ARMS will provide data on how the heart and lungs function in space, as well as how the nervous system controls them. Exercise will also be combined with breath holding and straining (the Valsalva maneuver) to test how heart rate and blood pressure react to different stresses. This understanding will improve astronauts' cardiopulmonary function after return to Earth, and may well help Earthbound patients who experience similar effects after long-term bed rest.

Author

*Spaceborne Experiments; Aerospace Technology Transfer; Technology Utilization; Physiological Effects; Blood Pressure; Cardiovascular System; Heart Function; Lungs*



*Includes human factors engineering; bionics, man-machine, life support, space suits and protective clothing. For related information see also 16 Space Transportation and 52 Aerospace Medicine..*

**20030007918** NASA Johnson Space Center, Houston, TX USA

**Bioregenerative Life Support Systems Test Complex (Bio-Plex) Food Processing System: A Dual System**

Perchonok, Michele, NASA Johnson Space Center, USA; Vittadini, Elena, NASA Johnson Space Center, USA; Peterson, Laurie J., NASA Johnson Space Center, USA; Swango, Beverly E., NASA Johnson Space Center, USA; Toerne, Mary E., NASA Johnson Space Center, USA; [2001]; 5p; In English; ICES Conference, 9-12 Jul. 2001, Orlando, FL, USA; Sponsored by Society of Automotive Engineers, Inc., USA; Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

A Bioregenerative Life Support Test Complex, BIO-Plex, is currently being constructed at the Johnson Space Center (JSC) in Houston, TX. This facility will attempt to answer the questions involved in developing a lunar or planetary base. The Food Processing System (FPS) of the BIO-Plex is responsible for supplying food to the crew in coordination with the chosen mission scenario. Long duration space missions require development of both a Transit Food System and of a Lunar or Planetary Food System. These two systems are intrinsically different since the first one will be utilized in the transit vehicle in microgravity conditions with mostly resupplied foods, while the second will be used in conditions of partial gravity (hypogravity) to process foods from crops grown in the facility. The Transit Food System will consist of prepackaged food of extended shelf life. It will be supplemented with salad crops that will be consumed fresh. Microgravity imposes significant limitation on the ability to handle food and allows only for minimal processing. The challenge is to develop food systems similar to the International Space Station or Shuttle Food Systems but with a shelf life of 3 - 5 years. The Lunar or Planetary Food System will allow for food processing of crops due to the presence of some gravitational force (1/6 to 1/3 that of Earth). Crops such as wheat, soybean, rice, potato, peanut, and salad crops, will be processed to final products to provide a nutritious and acceptable diet for the crew. Not only are constraints imposed on the FPS from the crops (e.g., crop variation, availability, storage and shelf-life) but also significant requirements are present for the crew meals (e.g., RDA, high quality, safety, variety). The FPS becomes a fulcrum creating the right connection from crops to crew meals while dealing with issues of integration within a closed self-regenerative system (e.g., safe processing, waste production, volumes, air contaminations, water usage, etc.). Options for the first test, for duration of 120 days, currently scheduled for late 2003 are outlined.

Author

*Closed Ecological Systems; Food Production (In Space); Consumables (Spacecrew Supplies); Nutrition; Space Flight Feeding; Research Facilities; Space Missions*

**20030010460** Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA

**Exoskeleton Power and Torque Requirements Based on Human Biomechanics**

Crowell, Harrison P., III; Boynton, Angela C.; Mungiole, Michael; Nov. 2002; 57p; In English  
Report No.(s): AD-A408684; ARL-TR-2764; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The Defense Advanced Research Projects Agency (DARPA) is funding the development of exoskeletal devices that are intended to increase the speed, strength, and endurance of soldiers in combat environments. The purpose for this work was to provide guidance for the design of the lower limbs of an exoskeletal device. In providing design guidance, the authors had two goals. The first goal was to provide estimates of the angles, torques, and powers for the ankles, knees, and hips of an exoskeleton based on data collected from humans. The second goal was to calculate the mean power required for various tasks and the total peak power needed by the lower limbs of the exoskeletal device for two "typical" infantry missions.

DTIC

*Biodynamics; Exoskeletons; Torque; Joints (Anatomy); Military Operations*

**20030011357** Army Aeromedical Research Lab., Fort Rucker, AL USA

**A Proposed Laser Safety Evaluation Plan for the Microvision, Inc., Scanning Laser Helmet-Mounted Display System Final Report**

Rash, Clarence E.; Harding, Thomas H.; Nov. 2002; 29p; In English  
Report No.(s): AD-A408903; USAARL-2003-01; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Program Manager, Aircrew Integrated Systems (PM-ACIS) is developing a scanning laser helmet-mounted display (HMD) that can be fitted to the U.S. Army Helmet Gear Unit 56P (HGU-56P) aviation helmet. This HMD is manufactured by Microvision Inc., Bothell, Washington. This HMD system represents the first scenario in which aviators will be directly and purposely viewing

laser energy. For this reason, in addition to standard required laser safety measures, an expanded effort is required to overcome ingrained aviator training to avoid exposure to laser energy. This report presents a proposed laser safety evaluation plan, which is intended to both document laser energy exposure levels during normal and system failure conditions, as well as provide enhanced safety information considered instrumental in achieving aviation community acceptance of this new HMD technology.

DTIC  
*Helmet Mounted Displays; Safety Management*

**20030011359** Army Aeromedical Research Lab., Fort Rucker, AL USA

**The Issue of Visual Correction Compatibility with Helmet-Mounted Displays *Final Report***

Rash, Clarence E.; Kalich, Melvyn E.; van de Pol, Corins; Reynolds, Barbara S.; Nov. 2002; 46p; In English  
Report No.(s): AD-A408908; USAARL-2003-04; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper examines the compatibility issues of helmet-mounted display (HMD) designs, the requirement for providing compatible vision correction, and the methods available in order to achieve this requirement. First, the problem of limited HMD eye clearance is defined in the context of protective devices and visual correction methods. Next, past efforts to mitigate this problem via the use of specially modified spectacles and contact lenses are reviewed. Finally, current and future potential solutions to this problem are explored.

DTIC  
*Visual Perception; Helmet Mounted Displays*

**20030011414** NASA Marshall Space Flight Center, Huntsville, AL USA

**Vapor Compression Distillation Flight Experiment**

Hutchens, Cindy F., NASA Marshall Space Flight Center, USA; STS 107 Shuttle Press Kit: Providing 24/7 Space Science Research; Dec. 16, 2002, pp. 97-99; In English; Also announced as 20030011376; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

One of the major requirements associated with operating the International Space Station is the transportation -- space shuttle and Russian Progress spacecraft launches - necessary to re-supply station crews with food and water. The Vapor Compression Distillation (VCD) Flight Experiment, managed by NASA's Marshall Space Flight Center in Huntsville, Ala., is a full-scale demonstration of technology being developed to recycle crewmember urine and wastewater aboard the International Space Station and thereby reduce the amount of water that must be re-supplied. Based on results of the VCD Flight Experiment, an operational urine processor will be installed in Node 3 of the space station in 2005.

Author  
*Spaceborne Experiments; Aerospace Technology Transfer; Technology Utilization; Water Reclamation; Urine; Phase Transformations*

**59**

**MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)**

*Includes general topics and overviews related to mathematics and computer science. For specific topics in these areas see categories 60 through 67.*

**20030010514** Naval Postgraduate School, Monterey, CA USA

**Summary of Research 2000, Department of Mathematics**

Morgan, Michael A.; Borges, Carlos; Dec. 2001; 28p; In English  
Report No.(s): AD-A408839; NPS-09-02-004; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report contains project summaries of the research projects in the Department of Mathematics. A list of recent publications is also included, which consists of conference presentations and publications, books, contributions to books, published journal papers, and technical reports. Thesis abstracts of students advised by faculty in the Department are also included. The NPS mathematics Department is committed to excellence. Our purpose is to provide an exceptional mathematical education focused on the unique needs of our students, to produce relevant research for our sponsors, and to provide quality service to the community. We further are committed to maintenance of a well-designed curriculum and a supportive environment for our students. The NPS Mathematics Department is committed to excellence. Our purpose is to provide an exceptional mathematical education focused on the unique needs of our students, to produce relevant research for our sponsors, and to provide quality service

to the community. We further are committed to maintenance of a well-designed curriculum and a supportive environment for our students.

DTIC

*Abstracts; Education; Students; Mathematics*

## 60

### COMPUTER OPERATIONS AND HARDWARE

*Includes hardware for computer graphics, firmware and data processing. For components see 33 Electronics and Electrical Engineering. For computer vision see 63 Cybernetics, Artificial Intelligence and Robotics.*

**20030010449** Naval Postgraduate School, Monterey, CA USA

#### **A National Trusted Computing Strategy**

Irvine, Cynthia E.; Levin, Timothy E.; Dinolt, George W.; May 2002; 17p; In English

Report No.(s): AD-A408641; NPS-CS-02-003; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Through neglect, the national capability to design and construct trusted computers and networks has begun to atrophy. Not only has the information infrastructure been built weakly, but also our capability to strengthen it continues to decline. The Nation is now lacking in both the research and development talent to produce trusted computing systems and the educational infrastructure to create this talent. The Center for INFOSEC Studies and Research (CISR) in Monterey, California, proposes a three-pronged approach to strengthen the national information infrastructure and reinvigorate the national capability to produce trustworthy computing systems. First, we describe our Trusted Computing Exemplar project as a worked example of how trusted computing systems and components can be constructed. Second, we define a national research initiative to advance the theoretical foundations for trusted computing and to produce a set of automated tools to support the development of high assurance systems; and third, we define an education at initiative based on nascent information Assurance education programs and the Trusted Computing Exemplar to provide a framework for Trusted Computer Development education. The result of this multi-faceted approach will be to increase the security of the national Information Infrastructure by increasing the availability of: Trusted Computer systems and components, Trusted Computer development tools, and Trusted Computer developers, evaluators and educators.

DTIC

*Computers; Computer Information Security; Computer Systems Programs; Data Processing*

**20030011299** Brigham Young Univ., Dept. of Spanish and Portuguese, Provo, UT USA

#### **A Comparison of the Effects of Two Schema Theory-Based Pre-Reading Activities in Spanish: Key Word Discussion and Vocabulary Review**

Nolan, Charles W., II; Aug. 2002; 138p; In English

Report No.(s): AD-A408585; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This Study compares the effectiveness of two schema theory-based pre-reading activities: key word discussion and vocabulary review. Background knowledge plays an important role in reading comprehension. Schema theory models the processing of information and the role that background knowledge plays in comprehension. Research suggests that reading strategies based on schema theory improve reading comprehension. In terms of pre-reading activities based on schema theory, Klapper (1993) claims that getting students to think about and predict content is more fruitful than reviewing difficult vocabulary items. The current study compared the effectiveness of these two types of pre-reading exercises in three sections of Spanish 102 students at Brigham Young University. A pretest was first conducted to establish that all three sections were comparable in reading comprehension skill. Each section then read each of three readings followed by a reading comprehension test. Prior to each reading, one section conducted a vocabulary review, another section conducted a class discussion of key words modeled after the Pre-Reading Plan (PReP) designed by Langer (1981), and the third section conducted a pre-reading activity that combined both the vocabulary review and the class discussion of key words. Each pre-reading activity lasted approximately 15 minutes. The three treatments were rotated so that each section participated in each treatment one time. Data from the pretest and treatment reading comprehension tests were analyzed in terms of the change in scores between the pretest and the reading comprehension tests. The analysis failed to show that one treatment was significantly more effective than the others in improving student reading comprehension. The only significant variable was reading selection. The more difficult the reading, the smaller the change in scores between the pretest and the treatment reading comprehension tests.

DTIC

*Performance Tests; Reading; Words (Language)*

**20030011501** Object Services and Consulting, Inc., Baltimore, MD USA

**Agility: Agent - Iility Architecture Final Report, Jun. 1998-Jun 2002**

Thompson, Craig; Bannon, Tom; Ford, Steve; Pazandak, Paul; Vasudevan, Venu; Oct. 2002; 78p; In English; Original contains color images

Contract(s)/Grant(s): F30602-98-C-0159; DARPA ORDER-J357; AF Proj. AGEN

Report No.(s): AD-A408751; AFRL-IF-RS-TR-2002-265; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Today's agent systems are monolithic, centralized, and do not provide a clear migration path for integration with mainstream technologies (e.g., object and web technologies). The objective of the Agility project is to develop an open agent grid architecture populated with scalable, deployable, industrial strength agent grid components, targeting the theme 'agents for the masses.' The overall technical approach has been to deconstruct agent systems into components, then populate an open agent grid architecture with scalable light-weight agent grid components that are engineered to piggyback on existing and emerging standards (e.g., distributed objects, email, web, search engines, XML, Java, Jini). Three agent system components resulted from this work: a light-weight agent system that uses email for message transport (eGents), a constrained natural language interface system that can wrap agents and other Internet resources and operate over the web (AgentGram), a yellow pages service that uses Internet search engines to locate XML ads for agents and other Internet resources (WebTrader).

DTIC

*Grids; Architecture (Computers)*

**61**

**COMPUTER PROGRAMMING AND SOFTWARE**

*Includes software engineering, computer programs, routines, algorithms, and specific applications, e.g., CAD/CAM. For computer software applied to specific applications, see also the associated category.*

**20030007694** Naval Postgraduate School, Monterey, CA USA

**MYSEA Security Architecture**

Irvine, Cynthia E.; Shifflett, David J.; Clark, Paul C.; Levin, Timothy E.; Dinolt, George W.; May 2002; 25p; In English

Contract(s)/Grant(s): MIPR-00-E583

Report No.(s): AD-A408173; NPS-CS-02-006; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We describe an innovative architecture consisting of trusted security services and integrated operating system mechanisms for the protection of distributed multi-domain computing environments from malicious code and other attacks. These security services and mechanisms extend and interoperate with existing workstations, applications and open source operating systems, providing new capabilities for composing secure distributed systems using commercial off-the-shelf (COTS) components. The latter construct results from the realization that unless a secure system offers users comfortable and familiar interfaces for handling routine information, the secure system will fail due to lack of user acceptability.

DTIC

*Computer Information Security; Commercial Off-The-Shelf Products; Architecture (Computers)*

**20030007698** Army Engineer Research and Development Center, Environmental Lab., Vicksburg, MS USA

**User's Manual for NAVEFF Navigation Effects Model Final Report**

Bourne, Scott; Sep. 2002; 73p; In English

Report No.(s): AD-A408165; ERDC/EL-TR-02-29; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The analysis of system-wide impacts begins with the Navigation Effects (NAVEFF) model. This user guide provides a detailed description of the NAVEFF model installation and execution. The format of the NAVEFF input and output files is documented in this user's guide. The NAVEFF model is a one-dimensional model that estimates the physical forces generated across a cross section caused by shallow draft navigation of a tow boat. NAVEFF is run at each half mile cross section for pools 4, 8, 13, 26, and LaGrange and at 1 mile cross section in the remaining pools. Inputs for NAVEFF are 108 different tow boat combinations, three river stages, and three sailing line locations. Output from NAVEFF includes maximum velocity change, maximum drawdown, maximum wave height, maximum bed scour, and maximum bed shear stress. The output from NAVEFF is one of the primary inputs to the other system ecological models and the sedimentation model.

DTIC

*Computer Programs; Manuals; Navigation; Boats*



**20030007707** Westat Research, Inc., Rockville, MD USA

**Tabulations of Responses from the 2000 Military Recruiter Survey, Volume 1**

Rockwell, David; Deak, Mary A.; Helba, Cynthia; Windle, Rose; Adebayo, Adefisayo; Aug. 2002; 664p; In English; Original contains color images

Contract(s)/Grant(s): DASW01-98-M-2108

Report No.(s): AD-A408154; JAMRS-2002-002; No Copyright; Avail: Defense Technical Information Center (DTIC)

In 1989, the first Recruiter Survey was administered to obtain baseline information regarding field recruiters' perceptions of issues related to recruiter quality of life. Since then, the Recruiter Survey has been administered in 1991, 1994, 1996, 1998 and 2000. The survey results provided are based on returns from active-duty Service production recruiters-- those with at least one year of recruiting experience and assigned a goal/mission. The Tabulations of Responses for the 2000 Military Recruiter Survey, Volume I contains tabulations of items 1-56 from the survey broken out by Service/ Component and geographical area.

DTIC

*Surveys; Armed Forces (USA); Personnel; Tabulation Processes*

**20030007776** College of William and Mary, Computer Science Div., Williamsburg, VA USA

**A Uniform Ontology for Software Interfaces Final Report, 28 Feb. 2001 - 28 Feb. 2002**

Feyock, Stefan, College of William and Mary, USA; [2002]; 19p; In English

Contract(s)/Grant(s): NAG1-2271

Report No.(s): W&M-301511; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

It is universally the case that computer users who are not also computer specialists prefer to deal with computers' in terms of a familiar ontology, namely that of their application domains. For example, the well-known Windows ontology assumes that the user is an office worker, and therefore should be presented with a "desktop environment" featuring entities such as (virtual) file folders, documents, appointment calendars, and the like, rather than a world of machine registers and machine language instructions, or even the DOS command level. The central theme of this research has been the proposition that the user interacting with a software system should have at his disposal both the ontology underlying the system, as well as a model of the system. This information is necessary for the understanding of the system in use, as well as for the automatic generation of assistance for the user, both in solving the problem for which the application is designed, and for providing guidance in the capabilities and use of the system.

Derived from text

*Computer Systems Programs; Software Engineering; Mathematical Models; Automatic Control; Applications Programs (Computers)*

**20030007794** Nielsen Engineering and Research, Inc., Mountain View, CA USA

**Overflow User's Manual (High-Order Compact Schemes Version), 1.0**

Chou, Harrison S. Y., Nielsen Engineering and Research, Inc., USA; Jan. 17, 2003; 65p; In English

Report No.(s): NEAR-TR-583-Vol-2; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The purpose of this manual is to provide the user with a quick reference in the theory, numerical formulation, implementation and running of the code for the high-order compact schemes version 1.0 of OVERFLOW. This version of high-order OVERFLOW has been developed and based on the NASA version of OVERFLOW 1.8r. Users should use this manual in combination with the original OVERFLOW 1.8r user's manual [Bunning, Jespersen, Pulliam, Klopfer, Chan, Slotnick, Krist and Renze 2000].

Derived from text

*User Manuals (Computer Programs); Mathematical Models; Applications Programs (Computers); Computational Fluid Dynamics*

**20030007796** Arizona State Univ., Office of Research and Creative Studies, Tempe, AZ USA

**Using a Formal Approach for Reverse Engineering and Design Recovery to Support Software Reuse Final Report, 1 Oct. 2001 - 30 Sep. 2002**

Gannod, Gerald C., Arizona State Univ., USA; [2002]; 49p; In English; Original contains color illustrations

Contract(s)/Grant(s): NAG1-2241; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This document describes 3rd year accomplishments and summarizes overall project accomplishments. Included as attachments are all published papers from year three. Note that the budget for this project was discontinued after year two, but

that a residual budget from year two allowed minimal continuance into year three. Accomplishments include initial investigations into log-file based reverse engineering, service-based software reuse, and a source to XML generator.

Author

*Reverse Engineering; Software Reuse; Software Engineering*

**20030007844** NASA Ames Research Center, Moffett Field, CA USA

**A De-centralized Scheduling and Load Balancing Algorithm for Heterogeneous Grid Environments**

Arora, Manish, Texas Univ., USA; Das, Sajal K., Texas Univ., USA; Biswas, Rupak, NASA Ames Research Center, USA; [2002]; 7p; In English

Contract(s)/Grant(s): NCC2-5395; Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; Distribution under U.S. Government purpose rights under grant number NCC2-5395; Distribution under U.S. Government purpose rights under grant number NCC2-5395

In the past two decades, numerous scheduling and load balancing techniques have been proposed for locally distributed multiprocessor systems. However, they all suffer from significant deficiencies when extended to a Grid environment: some use a centralized approach that renders the algorithm unscalable, while others assume the overhead involved in searching for appropriate resources to be negligible. Furthermore, classical scheduling algorithms do not consider a Grid node to be N-resource rich and merely work towards maximizing the utilization of one of the resources. In this paper, we propose a new scheduling and load balancing algorithm for a generalized Grid model of N-resource nodes that not only takes into account the node and network heterogeneity, but also considers the overhead involved in coordinating among the nodes. Our algorithm is decentralized, scalable, and overlaps the node coordination time with that of the actual processing of ready jobs, thus saving valuable clock cycles needed for making decisions. The proposed algorithm is studied by conducting simulations using the Message Passing Interface (MPI) paradigm.

Author

*Algorithms; Scheduling; Tasks; Multiprocessing (Computers)*

**20030007899** NASA Ames Research Center, Moffett Field, CA USA

**A De-Centralized Scheduling and Load Balancing Algorithm for Heterogeneous Grid Environments**

Arora, Manish, Texas Univ., USA; Das, Sajal K., Texas Univ., USA; Biswas, Rupak, NASA Ames Research Center, USA; May 01, 2002; 8p; In English; Workshop on Scheduling and Resource Management for Cluster Computing, 18-21 Aug. 2002, Vancouver, Canada

Contract(s)/Grant(s): NCC2-5395; RTOP 704-40-24; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

In the past two decades, numerous scheduling and load balancing techniques have been proposed for locally distributed multiprocessor systems. However, they all suffer from significant deficiencies when extended to a Grid environment: some use a centralized approach that renders the algorithm unscalable, while others assume the overhead involved in searching for appropriate resources to be negligible. Furthermore, classical scheduling algorithms do not consider a Grid node to be N-resource rich and merely work towards maximizing the utilization of one of the resources. In this paper we propose a new scheduling and load balancing algorithm for a generalized Grid model of N-resource nodes that not only takes into account the node and network heterogeneity, but also considers the overhead involved in coordinating among the nodes. Our algorithm is de-centralized, scalable, and overlaps the node coordination time of the actual processing of ready jobs, thus saving valuable clock cycles needed for making decisions. The proposed algorithm is studied by conducting simulations using the Message Passing Interface (MPI) paradigm.

Author

*Scheduling; Load Distribution (Forces); Multiprocessing (Computers); Algorithms; Scale Effect; Computational Grids; Computer Networks*

**20030007907** University of Electro-Communications, Dept. of Computer Science, Tokyo, Japan

**Hardware Organization of High-Radix SRT Division Based on the Logical Circuit Realization**

Ge, Yi, University of Electro-Communications, Japan; Abe, Koki, University of Electro-Communications, Japan; Hamada, Hozumi, University of Electro-Communications, Japan; Bulletin of the University of Electro-Communications; July 2002; ISSN 0915-0935; Volume 15, No. 1 (Serial No. 29), pp. 29-38; In English; Copyright; Avail: Issuing Activity

The hardware organization of the SRT division is categorized into two classes which we call the logical circuit realization and the table realization, where quotient digits are selected by means of logical circuits and a look-up table, respectively. In the logical circuit realization, quotient digits are selected by examining the sign digit of  $rR-kD$ , where  $r$  is the radix,  $R$  is the partial remainder,  $D$  is the divisor, and  $kD$  is a boundary line dividing the overlap region. Because of the overlap region,  $rR-kD$  containing

an error can be used in selection instead of the exact value of  $rR-kD$ . In convention the constant  $k$  is employed so that the line  $rR-kD$  examined in this paper, a carry propagate adder (CPA) determines the delay of the critical path. This paper describes that (1) we can reduce the CPA by one bit by employing other values for  $k$  than the conventional one; (2) even when using the conventional  $k$ , we can reduce the CPA by one bit by devising addition; (3) the logical circuit realization is more advantageous in speed than the table realization when the radix is high.

Author

*Logic Circuits; Hardware*

**20030009797** NASA Langley Research Center, Hampton, VA USA

**Bell-Curve Genetic Algorithm for Mixed Continuous and Discrete Optimization Problems**

Kincaid, Rex K., College of William and Mary, USA; Griffith, Michelle, College of William and Mary, USA; Sykes, Ruth, College of William and Mary, USA; Sobieszczanski-Sobieski, Jaroslaw, NASA Langley Research Center, USA; [2002]; 12p; In English; 43rd AIAA Structures, Structural Dynamics and Materials, 22-25 Apr. 2002, Denver, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): NAG1-2077

Report No.(s): AIAA Paper 2002-1675; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

In this manuscript we have examined an extension of BCB that encompasses a mix of continuous and quasi-discrete, as well as truly-discrete applications. FVe began by testing two refinements to the discrete version of BCB. The testing of midpoint versus fitness (Tables 1 and 2) proved inconclusive. The testing of discrete normal tails versus standard mutation showed was conclusive and demonstrated that the discrete normal tails are better. Next, we implemented these refinements in a combined continuous and discrete BCB and compared the performance of two discrete distance on the hub problem. Here we found when "order does matter" it pays to take it into account.

Derived from text

*Genetic Algorithms; Optimization; Discretization (Mathematics); Complex Variables*

**20030010360** Old Dominion Univ., Center for Advanced Engineering Environments, Hampton, VA USA

**Rule-based Natural-Language Interface for Virtual Environments**

Wasfy, Tamer M., Advanced Science and Automation Corporation, USA; Noor, Ahmed K., Old Dominion Univ., USA; Advances in Engineering Software; 2002; ISSN 0965-9978; Volume 33, pp. 155-168; In English

Contract(s)/Grant(s): NCC1-01040; Copyright; Avail: Issuing Activity

A hierarchical rule-based natural-language interface (NLI) for object-oriented virtual environment (VE) toolkits is described. The NLI allows modifying the properties of existing objects, as well as creating new objects in the VE using near-natural language speech. The rules are organized in a tree hierarchy with each rule branching to a 'group of rules'. Each tree-branch forms a possible user's command. Each rule generates global variables, which can be accessed by rules down the branch in order to formulate an appropriate action for the command. The action consists of a set of script commands that are sent to the VE. Also, the NLI maintains a state that allows it to respond to a command in the context of the previous command that the user issued. The hierarchical NLI exploits the object-oriented data structure of the VE toolkit by using three main levels of rules, namely, object, property, and action rules. The NLI can run on a remote computer and is linked to the computer running the VE via a network socket connection. The application of the NLI to the visualization of computational fluid dynamics results in a virtual wind tunnel is presented.

Author

*Natural Language (Computers); Virtual Reality; Artificial Intelligence; Scientific Visualization; Computational Fluid Dynamics*

**20030010452** Carnegie-Mellon Univ., Software Engineering Inst., Pittsburgh, PA USA

**Evolutionary Process for Integrating COTS-Based Systems (EPIC). Building, Fielding, and Supporting Commercial-off-the-Shelf (COTS) Based Solutions Final Report**

Albert, Cecilia; Brownsword, Lisa; Nov. 2002; 274p; In English

Contract(s)/Grant(s): F19628-00-C-0003

Report No.(s): AD-A408653; CMU/SEI-2002-005; ESC\*-TR-2002-005; No Copyright; Avail: CASI; A12, Hardcopy; A03, Microfiche

Government and private organizations are escalating their use of commercial off-the-shelf (COTS) and other pre-existing components in critical business systems. Attempts to exploit these components have often tailed with the use of traditional engineering approaches that involve defining requirements, formulating an architecture, and then searching for components that

meet the specified requirements within the defined architecture. Here we describe an alternative approach using the Rational Unified Process (RUP), a risk-based, disciplined, spiral-engineering approach. The Evolutionary Process for Integrating COTS-based systems (EPIC) redefines acquisition, management, and engineering practices to more effectively leverage the COTS marketplace and other sources of pre-existing components. This is accomplished through concurrent discovery and negotiation of diverse spheres of influence: user needs and business processes, applicable technology and components, the target architecture, and programmatic constraints. EPIC codifies these practices in a structured flow of key activities and artifacts. This document provides an overview of the EPIC framework along with its activities and artifacts.

DTIC

*Commercial Off-The-Shelf Products; Software Engineering; Management Information Systems; Architecture (Computers); Systems Integration*

**20030010464** Carnegie-Mellon Univ., Software Engineering Inst., Pittsburgh, PA USA

**Supporting the CANCEL Command Through Software Architecture Final Report**

Bass, Len; John, Bonnie E.; Dec. 2002; 22p; In English

Contract(s)/Grant(s): F19628-00-C-0003

Report No.(s): AD-A408691; CMU/SEI-2002-TN-021; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A system that supports the user's ability to cancel a command should be designed to achieve particular results. These results include the responses the system should make to the user, such as providing feedback to the user about the command's receipt, predicting the time the cancellation should take (for long-running cancellations), and indicating the state to which the system was returned after the completion of the cancellation. To support a cancellation command, a system should be designed so that the command is handled on a thread separate from that of the command being cancelled, the resources being used by the command being cancelled should be freed, and any processes collaborating with the command being cancelled should be informed of the cancellation. This note details the responsibilities that a system must implement to support command cancellation.

DTIC

*Architecture (Computers); User Requirements; Cancellation; Commands*

**20030011285** Air Force Research Lab., Human Effectiveness Directorate, Mesa, AZ USA

**Assessment of the Virtual Environment Safe-for-Maintenance Trainer (VEST) Final Report, Apr.-Aug. 2002**

Wenzel, Brenda M.; Castillo, Anna R.; Baker, Gerry; Sep. 2002; 26p; In English; Original contains color images

Contract(s)/Grant(s): AF Proj. 1123

Report No.(s): AD-A408680; AFRL-HE-AZ-TP-2002-0011; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The 363d Training Squadron (TRS), Sheppard AFB TX, is assessing the training effectiveness and usability of their Virtual Environment Safe-for-maintenance Trainer (VEST). VEST is an immersive virtual reality (VR) environment that provides demonstrations, drills, and checks on performance for F-15E model (a) cockpit switch familiarization, (b) weapons station identification, and (c) external aircraft safe-for-maintenance procedures. The assessment includes performance data and apprentices reactions to the training experience. Results from the initial assessment of VEST provide considerable evidence for the value in training aircraft maintenance technician apprentices with VR technology. Although training in a VR environment may be a new experience for apprentices, their performance scores reveal acceptable levels of learning. Results from the continuous assessment support the earlier finding that VEST provides effective training and experience that would otherwise not be afforded F-15E aircraft maintenance apprentice technicians. Apprentice comments reveal an overall positive learning experience with VEST. Their comments also reveal a negative perceptual experience. Improvements need to be made to VEST to minimize negative aspects of training in virtual environments. The negative comments indicated fixable problems, i.e., instructional aspects, graphics quality, joystick difficulties, monotonous synthetic voice, and general usability.

DTIC

*Computerized Simulation; Virtual Reality; Training Devices; Education*

**20030011346** Naval Postgraduate School, Monterey, CA USA

**Summary of Research 2000, Department of Computer Science**

Boger, Dan; Rowe, Neil C.; Dec. 2001; 104p; In English

Report No.(s): AD-A408857; NPS-09-02-003; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche



This report contains project summaries of the research projects in the Department of Computer Science. A list of recent publications is also included, which consists of conference presentations and publications, books, contributions to books, published journal papers, and technical reports. Thesis abstracts of students advised by faculty in the Department are also included.

DTIC

*Software Engineering; Military Technology; Research and Development*

**20030011502** Carnegie-Mellon Univ., Office of Sponsored Research, Pittsburgh, PA USA

**Resource-Centric Real-Time Kernel and Middleware Services Final Report, Jun. 1997-Dec. 2001**

Rajkumar, Raj; Oct. 2002; 24p; In English

Contract(s)/Grant(s): F30602-97-2-0287; AF Proj. F215

Report No.(s): AD-A408745; AFRL-IF-RS-TR-2002-260; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report provides an in depth look at the problem of OS resource management for real-time and multimedia systems where multiple activities with different timing constraints must be scheduled concurrently. Time on a particular resource is shared among its users and must be globally managed in real-time and multimedia systems. A resource kernel is meant for use in such systems and is defined to be one that provides timely, guaranteed and protected access to system resources. The resource kernel allows applications to specify only their resource demands leaving the kernel to satisfy those demands using hidden resource management schemes. This separation of resource specification from resource management allows OS-subsystem-specific customization by extending, optimizing, or even replacing resource management schemes. As a result, this resource-centric approach can be implemented with any of several different resource management schemes. Since the same application may consume a different amount of time on different platforms, the resource kernel must allow such resource consumption times to be portable across platforms, and to be automatically calibrated. Our resource management scheme is based on resource reservation and satisfies these goals.

DTIC

*Computer Networks; Software Engineering*

**20030011547** Army Construction Engineering Research Lab., Army Engineer Research and Development Center, Champaign, IL USA

**Building a Computable Facility Model**

Brucker, Beth A.; Wolfe, William J.; Oct. 2002; 3p; In English; Original contains color images

Report No.(s): AD-A408936; ERDC/CERL-TN-02-1; No Copyright; Avail: Defense Technical Information Center (DTIC)

The Architectural Engineering and Construction (AEC) industry has been making a substantial effort over the past several years to create a standard facility modeling format that better enables their different software applications to work together. This emerging standard is known as the Industry Foundation Class (IFC). With the evolution of this facility modeling standard, the ability to capture criteria and requirements during planning and design and then reuse this data during the life cycle of the facility is now possible. Providing interoperability among planning, design, construction, operations and maintenance, and recycling software applications will reduce the time necessary to process information about the facilities. This research effort is part of the 'Fort Future' program, the key objective of which is to develop a capability to model, simulate, assess, and optimize installation capability to support the Objective Force. Users of Fort Future, at the installation, regional, or national level will be able to set up planning scenarios, conduct dynamic analysis over a period of up to 30 years, and compare scenario results using a virtual installation.

DTIC

*Decision Support Systems; Armed Forces; Facilities; Simulation*

**20030011555** Trusted Information Systems, Inc., Glenwood, MD USA

**Advanced Security Proxy Technology for High Confidence Networks: Advances in Trust Negotiation Final Report, Aug. 2000-Jun. 2001**

Winsborough, William; Oct. 2002; 130p; In English

Contract(s)/Grant(s): F30602-97-C-0336; Proj-NSA1

Report No.(s): AD-A408633; AFRL-IF-RS-TR-2002-289-VOL-2/2; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This effort addresses the recent trend to fight battles with a coalition of forces from many different commands and countries. This also applies to the business world where companies are cooperating more in order to get new, innovative products on the marketplace, and insure that they all interface together. In order to exchange information between coalitions of organizations (businesses) that have no shared infrastructure and only limited mutual trust, there must be established some sort of bilateral

credential exchange, which is called trust negotiation (TN). to accomplish this, a common thread is established throughout this effort to support creation and management of sensitive credentials and policy content to use in attribute-based access control (ABAC). Current ABAC technology is either not sufficiently scalable to meet the needs of dynamic coalitions, or else provides the same access rights to all users. This is usually not desirable when fighting battles or making deals in the business world. In this study, steps are taken toward the goal of making ABAC systems that are highly scalable and fine grained, and to identify issues in the areas of distributed credential discovery, policy language design, and realistic TN strategies.

DTIC

*Commerce; Computer Networks; Computer Information Security; Access Control; Technology Utilization*

**20030011563** L-3 Communications Corp., Mesa, AZ USA

**Distributed Training Network Guard Trusted Bridge Federate Initial Capabilities Demonstration: After Action Report Interim Report, Jul.-Sep. 2002**

Martinez, Richard G.; Polliard, Steven; Flo, Robert; Oct. 2002; 24p; In English; Original contains color images

Contract(s)/Grant(s): F41624-97-D-5000; Proj-4924

Report No.(s): AD-A408651; AFRL-HE-AZ-TP-2002-0012; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Air Force Research Laboratory, Warfighter Training Research Division (AFRL/HEA) located in Mesa AZ, and the Information Systems Division (AFRL/IFS) in Rome NY, in conjunction with Trusted Computer Solutions Inc. (TCS) of Herndon VA (the primary development contractor) conducted an initial capabilities demonstration of the Distributed Training Network Guard (DTNG) Trusted Bridge Federate (TBF) on 25 July 2002. The DTNG program will design and develop both a TBF and a companion Security Reclassification Rule Set Intelligent Assistant Tool (SRRSIAT). Collectively, these two components are referred to as the DTNG. The TBF is the physical real-time automated network guard component that supports two-way data transfer between simulation federations operating at different security levels. The SRRSIAT is a stand-alone interactive graphical user interface application that provides the federation security classification/domain expert with the capability to develop and review classification rules that govern the transfer of objects, attributes, interactions, parameters, and the execution of cross security level Run-Time Infrastructure operations for cross federation object models. Although the initial capabilities of the TBF were successfully demonstrated through a series of test vignettes, there were several lessons learned throughout the integration effort and the demonstration event. The hope is that the lessons will serve to improve the future demonstration.

DTIC

*Computer Networks; Education; Artificial Intelligence; Applications Programs (Computers); Computer Assisted Instruction*

## 62

### COMPUTER SYSTEMS

*Includes computer networks and distributed processing systems. For information systems see 82 Documentation and Information Science. For computer systems applied to specific applications, see the associated category.*

**20030007688** National Inst. of Justice, Washington, DC USA

**Crisis Information Management Software (CIMS) Feature Comparison Report**

Oct. 2002; 62p; In English

Report No.(s): PB2003-101798; NCJ-197065; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The Crisis Information Management Software (CIMS) Test Bed Project was implemented by the U.S. Department of Justice, National Institute of Justice (NIJ)/Office of Science and Technology (OS&T), in support of its Critical Incident Technology Program (CITP). Through the CITP, NIJ advances the research and development of public safety technologies that will assist State and local law enforcement and other public safety professionals in the prevention of and their response to critical incidents, including acts of terrorism. CIMS, the software found in emergency management operation centers, supports the management of crisis information and the corresponding response by public safety agencies. The primary goal of the CIMS Test Bed Project is to assist Emergency Management Agencies (EMAs) in comparing and contrasting commercially available CIMS software.

NTIS

*Information Systems; Computer Systems Programs; Information Management; Emergencies*

**20030010283** Military Academy, West Point, NY USA

**The IWAR Range: A Laboratory for Undergraduate Information Assurance Education**

Schafer, Joseph; Ragsdale, Daniel J.; Surdu, John R.; Carver, Curtis A.; Nov. 07, 2000; 7p; In English; Original contains color images

Report No.(s): AD-A408301; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This paper describes a unique resource at West Point, the Information Analysis and Research Laboratory, referred to as the IWAR range. The IWAR range is an isolated laboratory used by undergraduate students and faculty researchers. The IWAR is a production-system-like, heterogeneous environment. The IWAR has become a vital part of the Information Assurance curriculum at West Point. We use the military range analogy to teach the students in the class that the exploits and other tools used in the laboratory are weapons and should be treated with the same care as rifles and grenades. This paper describes the structure of the laboratory and how it is used in classroom instruction. It also describes the process used to create the IWAR and how an IWAR might be built using limited resources. Finally this paper describes the future directions of the IWAR project.

DTIC

*Information Analysis; Education; Computer Information Security; Computer Networks*

**20030010284** Military Academy, West Point, NY USA

**Performance Modeling of AFATDS and Other Applications: Implications for Information Assurance and Security**

James, John R.; Ragsdale, Dan; Schafer, Joseph; Presby, Tim; Jun. 06, 2000; 8p; In English; Publ. in Proceedings of the 2000 IEEE Workshop on Information Assurance and Security, p11-17. Held at the U.S. Military Academy, West Point, NY, 6-7 Jun 2000

Report No.(s): AD-A408302; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Planning of complex activities is a deliberative process and automation support for re-planning activities should provide for cognitive modeling of the planning process. This paper takes the position that the cognitive model should contain details of the domain being supported and, especially for support of on-line re-planning, knowledge of the system implementation architecture-including performance modeling of the implementation architecture. We discuss these thoughts in some detail and provide an overview of a test bed framework being implemented to perform experiments on the validity of this approach. In particular, we are interested in creating analysis tools that apply metrics to sensed data to assist in determine when a re-planning activity is required and in prioritizing re-planning activities. The framework is intended to support experiments with military, decision making and with re-planning activities that support exertion of an Operation Order (OPORD). One of the products often created during OPORD preparation is the commander's Synchronization Matrix (also know as an Execution Matrix) to support coordination of operational activities by different units. Likewise during OPORD execution, if a synchronization matrix exists, monitoring of the degree to which actual events correspond to those entered in the synchronization matrix provides an effective approach to estimating whether the commander's Concept of the Operation is being followed. We are investigating use of a new simulation tool to accumulate information at the message-packet-level and perform analysis at the network-application-level. We discuss use of this framework for pattern recognition of activities distributed in time and space. Finally, we assert that this level of detail is required to enable assessment of the information assurance situation to support evaluation of risks, as well as implementation and application of metrics for analysis of alternatives for reacting to attacks.

DTIC

*Performance Prediction; Mathematical Models; Network Analysis; Computer Information Security; Military Technology; Management Planning*

**20030010503** Logistics Management Inst., McLean, VA USA

**A Practical Approach to Integrating Information Security into Federal Enterprise Architecture Final Report**

DiDuro, John; Crosslin, Robert; Dennie, Debra; Jung, Paul; Loudon, Christopher; Oct. 2002; 32p; In English; Original contains color images

Report No.(s): AD-A408768; LMI-IR229T1; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Security is a critically important consideration in government today. Managers are faced with a variety of security concerns driven by various laws, statutes, and regulations; agency policy; increased threat of terrorism; increased reliance on information technology; and issues of public trust. Security threats are cross-cutting, affecting IT planning, capital investment, systems design, operations, and IT governance. Failure to address security threats can interfere with a government organization's ability to carry out its mission. Simply implementing a variety of security mechanisms-the approach taken by most organizations-is not enough. Rather, security must be fully integrated into the organization's enterprise architecture. This report presents a methodology for doing that. The methodology is framework independent because it is based on the identification and description of business objects, which are common to all frameworks. The report also defines several concepts necessary for understanding the

methodology and describes the benefits a federal agency will derive. by integrating security into its FA, an organization can ensure proper alignment of security initiatives with enterprise drivers and can readily identify and address security threats.

DTIC

*Information Systems; Architecture (Computers); Integrated Circuits; Security*

**20030011523** Air Force Inst. of Tech., School of Engineering and Management, Wright-Patterson AFB, OH USA

**Modeling Information Assurance: A Value Focused Thinking Approach**

Hamill, Jonathan T.; Mar. 2000; 201p; In English; Original contains color images

Report No.(s): AD-A408832; AFIT/GOR/ENS/00M-15; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

The information revolution has brought forth new and improved capabilities to rapidly disseminate and employ information in decision-making. These capabilities are critical to the civilian and military infrastructures of the USA, and act as force enhancers and enablers for the Armed Forces. These capabilities, however, often rely upon systems interconnected throughout the world, resulting in potentially increased vulnerability to attack. to add to this problem, elusive, threatening forces (national and transnational) originating from anywhere on the globe are likely to offer opponents less reliant on information technology an asymmetric advantage over information-reliant nations like the USA. to date, effective methods and measures to specifically value information and information systems are lacking. This thesis develops a first cut methodology facilitating the identification of key information, generating information assurance strategies and implementing measures to assess them.

DTIC

*Information Systems; Decision Making*

**20030011534** USA Joint Forces Command, Norfolk, VA USA

**Capstone Requirements Document**

Aug. 30, 2001; 100p; In English; Original contains color images

Report No.(s): AD-A408877; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

The concept of a 'Global Information Grid' (GIG) was born out of concerns regarding interoperability and end-to-end integration of automated information systems. Issues such as streamlined management and the improvement of information infrastructure investment have also contributed to the heightened interest in a GIG. However, the real demand for a GIG has been driven by the requirement for information superiority and decision superiority to achieve full spectrum dominance, as expressed in Joint Vision 2020 (JV 2020). JV 2020 also highlights the importance of a network-centric warfare (NCW) environment, enabled by the GIG by means of dramatically improved information sharing through the robust networking of warfighting forces. As depicted in Figure 1 the GIG provides the enabling foundation for NCW 2 information superiority.

DTIC

*Automatic Control; Information Management; Management Information Systems; Computer Networks*

## 63

### CYBERNETICS, ARTIFICIAL INTELLIGENCE AND ROBOTICS

*Includes feedback and control theory, information theory, machine learning, and expert systems. For related information see also 54 Man/System Technology and Life Support.*

**20030007717** Sandia National Labs., Albuquerque, NM USA

**Volumetric Video Motion Detection for Unobstrusive Human-Computer Interaction**

Small, D. E.; Luck, J. P.; Carlson, J. J.; Apr. 2002; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM

Report No.(s): DE2002-800789; SAND2002-0801; No Copyright; Avail: National Technical Information Service (NTIS)

The computer vision field has undergone a revolution of sorts in the past five years. Moore's law has driven real-time image processing from the domain of dedicated, expensive hardware, to the domain of commercial off-the-shelf computers. This thesis describes their work on the design, analysis and implementation of a Real-Time Shape from Silhouette Sensor (RT S(sup 3)). The system produces time-varying volumetric data at real-time rates (10-30Hz). The data is in the form of binary volumetric images. Until recently, using this technique in a real-time system was impractical due to the computational burden. In this thesis they review the previous work in the field, and derive the mathematics behind volumetric calibration, silhouette extraction, and shape-from-silhouette.

NTIS

*Computer Vision; Cameras; Human-Computer Interface; Video Equipment; Motion Pictures*



**20030010286** Maryland Univ., Inst. for Advanced Computer Studies, College Park, MD USA

**Gesture-Based Control of Spaces and Objects in Augmented *Final Report, 1 Dec. 1999-30 Nov. 2002***

Yacoob, Yaser; Davis, Larry; Oct. 01, 2002; 31p; In English

Report No.(s): AD-A408623; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A multi-modal system integrating computer vision and speech recognition to enable interaction with virtual spaces/objects by natural gestures and speech is described. Computer vision algorithms are employed to measure and interpret hand/finger movement of the user. Our research focuses on detection, tracking, recognition and visual feedback of the hand and finger movements in a cooperative user environment and the integration of gesture and speech recognition for man/machine communication.

DTIC

*Computer Vision; Speech Recognition; Systems Integration; Image Processing; Algorithms*

**20030011272** NASA Langley Research Center, Hampton, VA USA

**Multirate Flutter Suppression System Design for the Benchmark Active Controls Technology Wing, Part 2, Methodology Application Software Toolbox**

Mason, Gregory S., Washington Univ., USA; Berg, Martin C., Washington Univ., USA; Mukhopadhyay, Vivek, NASA Langley Research Center, USA; December 2002; 47p; In English

Contract(s)/Grant(s): RTOP 706-17-51-03

Report No.(s): NASA/TM-2002-212129/PT2; NAS 1.15:212129/PT2; L-18249/PT2; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

To study the effectiveness of various control system design methodologies, the NASA Langley Research Center initiated the Benchmark Active Controls Project. In this project, the various methodologies were applied to design a flutter suppression system for the Benchmark Active Controls Technology (BACT) Wing. This report describes the user's manual and software toolbox developed at the University of Washington to design a multirate flutter suppression control law for the BACT wing.

Author

*Wings; Control Systems Design; Active Control; Vibration Damping*

**20030011273** NASA Langley Research Center, Hampton, VA USA

**Multirate Flutter Suppression System Design for the Benchmark Active Controls Technology Wing, Part 1, Theory and Design Procedure**

Mason, Gregory S., Washington Univ., USA; Berg, Martin C., Washington Univ., USA; Mukhopadhyay, Vivek, NASA Langley Research Center, USA; December 2002; 56p; In English

Contract(s)/Grant(s): RTOP 706-17-51-03

Report No.(s): NASA/TM-2002-212128/PT1; NAS 1.15:212128/PT1; L-18248/PT1; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

To study the effectiveness of various control system design methodologies, the NASA Langley Research Center initiated the Benchmark Active Controls Project. In this project, the various methodologies were applied to design a flutter suppression system for the Benchmark Active Controls Technology (BACT) Wing. This report describes a project at the University of Washington to design a multirate suppression system for the BACT wing. The objective of the project was two fold. First, to develop a methodology for designing robust multirate compensators, and second, to demonstrate the methodology by applying it to the design of a multirate flutter suppression system for the BACT wing.

Author

*Active Control; Control Systems Design; Vibration Damping; Wings*

## 64

### NUMERICAL ANALYSIS

*Includes iteration, differential and difference equations, and numerical approximation.*

**20030007883** NASA Ames Research Center, Moffett Field, CA USA

**Multilevel Error Estimation and Adaptive h-Refinement for Cartesian Meshes with Embedded Boundaries**

Aftosmis, M. J., NASA Ames Research Center, USA; Berger, M. J., New York Univ., USA; Jan. 08, 2002; 15p; In English; 40th AIAA Aerospace Sciences Meeting and Exhibit, 14-17 Jan. 2002, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): F49620-00-1-0099; DE-FG02-88ER-25053; DE-FG02-92ER-25139

Report No.(s): AIAA Paper 2002-0863; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

This paper presents the development of a mesh adaptation module for a multilevel Cartesian solver. While the module allows mesh refinement to be driven by a variety of different refinement parameters, a central feature in its design is the incorporation of a multilevel error estimator based upon direct estimates of the local truncation error using tau-extrapolation. This error indicator exploits the fact that in regions of uniform Cartesian mesh, the spatial operator is exactly the same on the fine and coarse grids, and local truncation error estimates can be constructed by evaluating the residual on the coarse grid of the restricted solution from the fine grid. A new strategy for adaptive h-refinement is also developed to prevent errors in smooth regions of the flow from being masked by shocks and other discontinuous features. For certain classes of error histograms, this strategy is optimal for achieving equidistribution of the refinement parameters on hierarchical meshes, and therefore ensures grid converged solutions will be achieved for appropriately chosen refinement parameters. The robustness and accuracy of the adaptation module is demonstrated using both simple model problems and complex three dimensional examples using meshes with from  $10(\exp 6)$ , to  $10(\exp 7)$  cells.

Author

*Error Analysis; Computational Fluid Dynamics; Grid Generation (Mathematics); Cartesian Coordinates; Computational Grids; Parameterization; Boundary Layers*

**20030007916** NASA Langley Research Center, Hampton, VA USA

**Finite Element Modeling of the NASA Langley Aluminum Testbed Cylinder**

Grosveld, Ferdinand W., Lockheed Martin Engineering and Sciences Co., USA; Pritchard, Joselyn I., NASA Langley Research Center, USA; Buehrle, Ralph D., NASA Langley Research Center, USA; Pappa, Richard S., NASA Langley Research Center, USA; [2002]; 12p; In English; 8th AIAA/CEAS Aeroacoustics Conference, 17-19 Jun. 2002, Breckenridge, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Original contains color illustrations

Contract(s)/Grant(s): NAS1-00135

Report No.(s): AIAA Paper 2002-2418; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution under U.S. Government purpose rights under contract number NAS1-00135; Distribution under U.S. Government purpose rights under contract number NAS1-00135

The NASA Langley Aluminum Testbed Cylinder (ATC) was designed to serve as a universal structure for evaluating structural acoustic codes, modeling techniques and optimization methods used in the prediction of aircraft interior noise. Finite element models were developed for the components of the ATC based on the geometric, structural and material properties of the physical test structure. Numerically predicted modal frequencies for the longitudinal stringer, ring frame and dome component models, and six assembled ATC configurations were compared with experimental modal survey data. The finite element models were updated and refined, using physical parameters, to increase correlation with the measured modal data. Excellent agreement, within an average 1.5% to 2.9%, was obtained between the predicted and measured modal frequencies of the stringer, frame and dome components. The predictions for the modal frequencies of the assembled component Configurations I through V were within an average 2.9% and 9.1%. Finite element modal analyses were performed for comparison with 3 psi and 6 psi internal pressurization conditions in Configuration VI. The modal frequencies were predicted by applying differential stiffness to the elements with pressure loading and creating reduced matrices for beam elements with offsets inside external superelements. The average disagreement between the measured and predicted differences for the 0 psi and 6 psi internal pressure conditions was less than 0.5%. Comparably good agreement was obtained for the differences between the 0 psi and 3 psi measured and predicted internal pressure conditions.

Author

*Finite Element Method; Aluminum; Test Stands; Cylindrical Bodies; Mathematical Models*

**20030011484** Iowa State Univ. of Science and Technology, Dept. of Mathematics, Ames, IA USA

**Coupling of Kinetic Equations and Their Hydrodynamic Limits *Final Report, 1 Apr. 1999-30 Nov. 2001***

Tidiri, M.; Nov. 2001; 25p; In English

Contract(s)/Grant(s): F49620-99-1-0197

Report No.(s): AD-A408735; AFRL-SR-AR-TR-02-0358; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

During the last two years, the author continued his efforts to reach the above objectives. In particular he focused on the following: Further numerical and theoretical studies of the coupling of Boltzmann equation and its hydrodynamic limits. Numerical and theoretical analysis of the coupling of kinetic equations and their hydrodynamic limits for particular kinetic models. (This gives more insight into the coupling method for the full Boltzmann model). Numerical and mathematical studies of the coupling of BCE and ES-BCE with their hydrodynamic limits. (The study of BCE and ES-BCE led the author to replace in the coupling of Boltzmann equations and their hydrodynamic limits, the Boltzmann equations by ES-BCE model. The author plan now is to show that this resulting coupling is optimal and can be used for the numerical simulation of flows around full airplanes at high altitudes). This study is subdivided into two parts. In the monoatomic case, the author is developing and validating his coupling using Direct Simulation Monte Carlo method for the kinetic model. He is also planning on developing a deterministic approach for the kinetic model. This will cut the computer cost considerably and allows for the computations around full airplanes. In the polyatomic case, the author is developing and validating his coupling using Direct Simulation Monte Carlo method for the kinetic model when an internal energy variable is used.

DTIC

*Kinetics; Hydrodynamics; Boltzmann Transport Equation*

## 65

### STATISTICS AND PROBABILITY

*Includes data sampling and smoothing; Monte Carlo method; time series and analysis; and stochastic processes.*

**20030007726** NASA Langley Research Center, Hampton, VA USA

#### **Random Walk Method for Potential Problems**

Krishnamurthy, T., NASA Langley Research Center, USA; Raju, I. S., NASA Langley Research Center, USA; [2002]; 8p; In English; 43rd AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, 22-25 Apr. 2002, Denver, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 2002-1654; Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; Distribution under U.S. Government purpose rights; Distribution under U.S. Government purpose rights

A local Random Walk Method (RWM) for potential problems governed by Laplace's and Paragon's equations is developed for two- and three-dimensional problems. The RWM is implemented and demonstrated in a multiprocessor parallel environment on a Beowulf cluster of computers. A speed gain of 16 is achieved as the number of processors is increased from 1 to 23.

Author

*Multiprocessing (Computers); Random Walk; Problem Solving*

**20030011487** Materials Research Society, Warrendale, PA USA

#### **Symposium T 'Statistical Mechanical Modeling in Materials Research' Final Report, 1 Nov. 2001-30 Apr. 2002**

Bartelt, Maria; Evans, James; Karma, Alain S.; Torquato, Salvatore; Wolf, Dietrick; Aug. 13, 2002; 19p; In English

Contract(s)/Grant(s): F49620-01-1-0003

Report No.(s): AD-A408724; AFRL-SR-AR-TR-02-0388; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Symposium T Objective: to showcase recent developments in statistical mechanical modeling of non-equilibrium structures and processes in materials (including film growth, solidification processes, and bulk defect dynamics).

DTIC

*Statistical Mechanics; Mathematical Models*

**20030011510** Air Force Research Lab., Propulsion Directorate West, Edwards AFB, CA USA

#### **Monte Carlo Simulations of the Structures and Optical Absorption Spectra of AlAr(sub N) Clusters**

Boatz, Jerry A.; Sheehy, Jeffery A.; Langhoff, Peter W.; Apr. 30, 1998; 24p; In English; Prepared in cooperation with Indiana Univ., Bloomington, Indiana

Contract(s)/Grant(s): AF Proj. 2303

Report No.(s): AD-A408581; AFRL-PR-ED-TP-1998-092; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Classical Monte Carlo simulation techniques have been used in conjunction with recently devised spectral methods for constructing the ground and low-lying excited state potential energy surfaces of atomic aggregates to predict the structures and optical absorption spectra of AlAr(sub N) clusters. The new spectral theory properly accounts for the change in electronic state character encountered in avoided crossings of diatomic adiabatic states and of the associated AlAr(sub N) aggregate states, in

contrast to strictly pairwise-additive methods such as the Balling and Wright model, which constitute special limiting cases of the general spectral theory.

DTIC

*Monte Carlo Method; Aluminum; Diatomic Molecules; Absorption Spectra; Argon; Spectral Theory; Wave Functions*

## 66

### SYSTEMS ANALYSIS AND OPERATIONS RESEARCH

*Includes mathematical modeling of systems; network analysis; mathematical programming; decision theory; and game theory.*

**20030010451** University of Central Florida, Inst. for Simulation and Training, Orlando, FL USA

**Low-Cost PC Gaming and Simulation Research: Doctrinal Survey Final Report, Jan.-Dec. 2001** *Send MAI*

Tarr, Ronald W.; Morris, Christina S.; Singer, Michael J.; Knerr, Bruce; Oct. 2002; 63p; In English

Contract(s)/Grant(s): Proj-A790

Report No.(s): AD-A408645; ARI-RN-2003-03; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The U.S. Army Simulation, Training and Instrumentation Command (STRICOM) established a program investigating novel techniques for low-cost/complexity training devices. The U.S. Army Research Institute for the Behavioral and Social Sciences contributed to this program by supporting the investigation of doctrinal issues in low-cost personal computer (PC) gaming. The Institute for Simulation and Training at the University of Central Florida developed an approach for defining game parameters and surveying subject matter experts (SMEs) on doctrinal correctness of game experiences. Doctrinal correctness combines and interacts with cognitive skills and decision-making skills gains in complex ways that make the selection of games for reinforcing training through training a complicated trade-off. Based on prior work, PC games were selected for Infantry and Armor tasks and evaluated for application and doctrinal correctness. The evaluations for the Infantry aspects of *Rogue Spear: Covert Ops(TM)* indicated that the game could be used for tactical movement, tactical scenario, and room clearing exercises. The evaluation of *Steel Beasts(TM)* were positive in terms of gunnery elements, but there were sufficient doctrinal errors that the overall game was judged to not be useful. The results of this and other efforts indicate the potential usefulness of commercially available off the shelf PC games, although further studies are needed in order to establish guidelines and characteristics for integrating selected aspects of games into ongoing instructional approaches.

DTIC

*Computerized Simulation; Microcomputers; Game Theory*

**20030010515** Naval Postgraduate School, Monterey, CA USA

**Summary of Research 2000, Department of Operations Research**

Eagle, James D.; Wood, Kevin R.; Dec. 2001; 81p; In English

Report No.(s): AD-A408840; NPS-09-02-008; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This report contains project summaries of the research projects in the Department of Operations Research. A list of recent publications is also included, which consists of conference presentations and publications, books, contributions to books, published journal papers, and technical reports. Thesis abstracts of students advised by faculty in the Department are also included. The research program at the Naval Postgraduate School exists to support the graduate education of our students. It does so by providing military relevant thesis topics that address issues from the current needs of the Fleet and Joint Forces to the science and technology that is required to sustain the long-term superiority of the Navy/DoD. It keeps our faculty current on Navy/DoD issues, to maintain the content of the upper division courses at the cutting edge of their disciplines. At the same time, the students and faculty together provide a very unique capability within the DoD for addressing warfighting problems. Our officers must be able to think innovatively and have the knowledge and skills that will let them apply technologies that are being rapidly developed in both the commercial and military sectors. Their unique knowledge of the operational Navy, when combined with a challenging thesis project that requires them to apply their focused graduate education, is one of the most effective methods for both solving Fleet problems and instilling the life-long capability for applying basic principles to the creative solution of complex problems.

DTIC

*Abstracts; Operations Research; Research and Development; Navy; Education*



70  
**PHYSICS (GENERAL)**

*Includes general research topics related to mechanics, kinetics, magnetism, and electrodynamics. For specific areas of physics see categories 71 through 77. For related instrumentation see 35 Instrumentation and Photography; for geophysics, astrophysics or solar physics see 46 Geophysics, 90 Astrophysics, or 92 Solar Physics.*

**20030007909** Stanford Linear Accelerator Center, Stanford, CA USA

**Separators for SLAC B-Factory**

Chernyakin, A. D.; Eschenko, V. N.; Gourko, V. F.; Karasyuk, V. N.; Khilchenko, A. D.; Aug. 2002; 8p; In English  
Report No.(s): DE2002-800066; SLAC-PUB-9448; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

In order to separate the beams during injection, a closed vertical bump will be introduced in the B-Factory High Energy Ring (HER) using four dedicated, pulsed magnets. measurements. The design field in the magnets is  $B_{(sub\ 0)} = 660\text{ G}$ ; the field integrals of the magnets are nominally: (Integral)  $Hdl = 0.0450\text{ T.m}$ ; (Integral)  $Hdl = 0.0420\text{ T.m}$ ; (Integral)  $Hdl = 0.0756\text{ T.m}$ ; (Integral)  $HDL = 0.0832\text{ T.m}$  The magnet apertures are 15 cm horizontal along the field direction and 10 cm in the vertical direction. The beams will be separated with a rise time of about 200 ms at the end of a coast and brought back into collision within about 1 ms. The magnets have been made and tested successfully at BINP and at SLAC. The whole system including pulsed power supply and shunts were also tested successfully.

NTIS

*Beam Splitters; Separators; Collisions*

**20030011350** California State Univ., Northridge, CA USA

**A Joint Maximum-Likelihood-Based Phase and Timing Synchronizer for Dual-h, Full-Response 4-ary CPM**

Pettit, R. H.; Wahlen, B. E.; Sep. 2002; 24p; In English

Report No.(s): AD-A408868; TD-3143; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Maximum likelihood techniques are useful in finding synchronizer structures for various cases. Synchronizers for frequency phase, and timing have been found for various bandpass signaling techniques such as PSK, DPSK, QAM, MSK, and CPM. These include data-aided decision directed, and clock-aided cases. This report describes a new nondata-aided, non-decision-directed ML-based phase and timing synchronizer for a dual-h, full-response, 4-ary CPM waveform. The derived structure will be incorporated into future simulations to compare performance among several possible phase and timing synchronizations.

DTIC

*Phase Modulation; Synchronism; Maximum Likelihood Estimates*

**20030011362** Academy of Sciences of the Ukraine, Inst. of Radiophysics and Electronics, Kharkov Ukraine

**2002 International Conference on Mathematical Methods in Electromagnetic Theory (MMET 02). Volume 1**

Sep. 2002; 336p; In English

Contract(s)/Grant(s): N62558-02-M-6003

Report No.(s): AD-A408919; R/D-9294-EE-02; No Copyright; Avail: CASI; A15, Hardcopy; A03, Microfiche

These proceedings concern mathematical methods in electromagnetic theory which include these topics: plenary sessions, time-domain methods, computational optoelectronics, printed antennas and circuits, georadar and remote sensing and wire and waveguide antennas.

DTIC

*Electromagnetism; Planar Structures*

**20030011559** Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

**Strain Rate Effect on Crack Opening and Growth in a Particulate Composite Material at Low Temperature**

Liu, C. T.; Aug. 10, 2002; 19p; In English; Viewgraphs only. Pres. at Conference on Mechanics of Time Dependent Materials (3rd). Held in Erlangen, Germany, 18-20 Sep 2000

Contract(s)/Grant(s): Proj-2302

Report No.(s): AD-A408647; AFRL-PR-ED-TP-2000-163; AFRL-PR-ED-TP-2000-163; No Copyright; Avail: Defense Technical Information Center (DTIC)

Viewgraphs from presentation given at the Third Conference on Mechanics of Time Dependent Materials, held in Erlangen, Germany, from 18-20 September 2000.

DTIC

*Composite Materials; Crack Propagation; Low Temperature; Particulates; Strain Rate; Conferences*

## 71 ACOUSTICS

*Includes sound generation, transmission, and attenuation. For noise pollution see 45 Environment Pollution. For aircraft noise see also 02 Aerodynamics and 07 Aircraft Propulsion Propulsion and Power.*

**20030007786** Swedish Defence Research Establishment, Div. of Systems Technology, Stockholm, Sweden

**Sonar Technology for Detection of Buried Objects *Sonarteknik foer Detektion av Begravda Objekt***

Pihl, J. P.; Ulriksen, P.; Jacobsen, N.; Moren, P.; Joensson, M.; Dec. 2001; 28p; In Swedish

Report No.(s): PB2003-101034; FOI-R-0323-SE; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The capability to detect objects buried in the sea bottom is important both for the civilian society and for military purposes. For example, there are many places in the Baltic Sea where ammunition and poisonous gases have been dumped. At FOI we are developing techniques for the detection as part of the European MAST program and the University of Lund. The scientific results from this work have been reported in papers and at conferences, but we have not given a description of our techniques. Therefore we present these in this report. We give a description of our underwater remotely operated vehicle, the PLUMS, together with a short description of sonar theory. We also give some recommendations on further work to be done in this research area.

NTIS

*Sonar; Detection; Ammunition; Underwater Tests; Remote Sensors*

**20030007787** Swedish Defence Research Establishment, Div. of Systems Technology, Stockholm, Sweden

**Acoustic Detection of Buried Objects *Akustisk Detektion av Begravda Objekt***

Ivansson, S.; Jacobsen, N.; Levonen, M.; Nilsson, B.; Moren, P.; Dec. 2001; In Swedish

Report No.(s): PB2003-101035; FOI-R-0324-SE; No Copyright; Avail: National Technical Information Service (NTIS)

The capability to detect objects buried in the sea bottom is important for many reasons. For example bottom mines as well as dumped chemical munitions can be expected to have been buried by the sedimentation. Standard sub-bottom profilers that are routinely used for mapping sediment structures do not have good enough resolutions to detect small buried objects. Parametric sonar, with a much smaller lobe, is much more appropriate. In the report, we show results from measurements with a parametric sonar, mounted on a ROV (remotely operated vehicle). The measurements were made in the archipelago of Stockholm with a test object buried in clay. Two techniques were used to improve the detection capability, image processing and FARIM analysis. Concerning image processing, median filtering turns out to provide the best results. Isolated noisy pings are effectively suppressed in this way. FARIM analysis can be used to estimate roughness and impedance of the bottom. Our experiments show that a buried object can often be detected by an anomaly in the impedance estimate. Among three tested center frequencies for the emitted pulse, 5, 10 and 20 kHz, the highest frequency (20 kHz) turns out to provide the best detection capability. This is true for the image processing results as well as for the FARIM results. We have tried bistatic techniques to characterize a detected buried object. Sound pulses are emitted towards the object from one direction and the scattered energy is studied at another direction. We show computational results from a recently developed numerical model. The scattered field turns out to be very sensitive to the properties of the object.

NTIS

*Sonar; Sound Detecting and Ranging; Underwater Acoustics; Remote Sensors*

**20030010511** Naval Undersea Warfare Center, Newport, RI USA

**Calibration, Measurement, and Voltage Output of Velocity Hydrophones**

Chen, Tien-Chay; Jul. 15, 2002; 16p; In English; Original contains color images

Report No.(s): AD-A408817; NUWC-NPT-TR-11385; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report discusses how to calibrate velocity hydrophones using a standard pressure hydrophone and investigates the relative contributions by the pressure and particle velocity to the measured sensitivity of such hydrophones. Sections 2 and 3 deal with the issues associated with velocity hydrophone calibration using a standard pressure hydrophone and the required correction factor for sensitivity calibration in a spherical wavefront. Section 4 summarizes the particle velocity's voltage contribution to the measured sensitivity of the hydrophone in a spherical wavefront. An example is presented in section 5 to illustrate the particle velocity's voltage contribution.

DTIC

*Calibrating; Hydrophones; Underwater Acoustics; Acoustic Velocity*

## ATOMIC AND MOLECULAR PHYSICS

*Includes atomic and molecular structure, electron properties, and atomic and molecular spectra. For elementary particle physics see 73 Nuclear Physics.*

**20030007700** Defence Research and Development Canada, Ottawa, Ontario Canada

**Computer Aided Dosimetry and Verification of Exposure to Radiation**

Waller, Edward; Stodilka, Robert Z.; Leach, Karen E.; Lalonde, Louise; Jun. 2002; 90p; In English; Original contains color images  
Report No.(s): AD-A408163; DRDC-TR-2002-055; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

In the timeframe following the September 11th attacks on the United States, increased emphasis has been placed on Chemical, Biological, Radiological and Nuclear (CBRN) preparedness. of prime importance is rapid field assessment of potential radiation exposure to Canadian Forces field personnel. This work set up a framework for generating an 'expert' computer system for aiding and assisting field personnel in determining the extent of radiation insult to military personnel. Data was gathered by review of the available literature, discussions with medical and health physics personnel having hands-on experience dealing with radiation accident victims, and from experience of the principal investigator. Flow charts and generic data fusion algorithms were developed. Relationships between known exposure parameters, patient interview and history, clinical symptoms, clinical work-ups, physical dosimetry, biological dosimetry, and dose reconstruction as critical data indicators were investigated. The data obtained was examined in terms of information theory. A main goal was to determine how best to generate an adaptive model (i.e. when more data becomes available, how is the prediction improved). Consideration was given to determination of predictive algorithms for health outcome. In addition, the concept of coding an expert medical treatment advisor system was developed (U) DTIC

*Radiation Dosage; Armed Forces; Personnel; Expert Systems*

**20030010450** Montana State Univ., Dept. of Physics, Bozeman, MT USA

**Advanced Semiconductor Light Emitting Materials Final Report, 1 Sep. 1996-31 Aug. 2000**

Lapeyre, Gerald J.; Wu, Huasheng; Yu, Mickey; Oct. 18, 2002; 126p; In English; Prepared in cooperation with Univ. of Hong Kong, Hong Kong, China and IBM Microelectronics, Essex Junction, VT  
Contract(s)/Grant(s): N00014-96-1-1240; DMR-9107854; Proj-96PR07849-00

Report No.(s): AD-A408644; Z1073/429364; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Photoelectron spectroscopy (PES) methods were developed for investigating interface and bulk properties of crystals for advanced electronic devices and optical devices. These and established PES methods were used to probe and characterize two classes of materials. One is wide-band gap semiconductors (GaN is prototype), which are under development for high frequency and high power electronic devices as well as short wave length light emitters such as bioagent detectors: For CVD hexagonal oriented GaN we measured the bulk electronic structure BANDS and the surface electronic states. The interface formation with Mg adsorption is determined. A unique internal-reference-beam holography method was developed and used to measure surface atomic positions and applied to Mg on GaN. The photoelectron-holographic-imaging technique was also used for ethylene and acetylene site data on the 100 face of silicon. The other material system is insulators doped with rare-earth atoms for optical information devices. For the first time the 4f rare-earth levels were measured with reference to the host (YAG) band gap.

DTIC

*Photoelectron Spectroscopy; Semiconductors (Materials); Light Emitting Diodes; Energy Gaps (Solid State); Imaging Techniques*

**20030011503** Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

**Spectral Theory of Schroedinger Eigenstates: Theory and Applications for Atomic Aggregates**

Langhoff, P. W.; Boatz, J. A.; Sheehy, J. A.; Fajardo, M. E.; Apr. 30, 1998; 14p; In English; Prepared in collaboration with Dept. of Chemistry, Indiana Univ., Bloomington, IN. Briefing notes only

Contract(s)/Grant(s): Proj-2303

Report No.(s): AD-A408618; AFRL-PR-ED-TP-1998-098; AFRL-PR-ED-TP-1998-098; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Progress is reported in the development and application of spectral methods for constructing the adiabatic electronic eigenstates and associated potential energy surfaces of metal-seeded cryogenic clusters relevant to the USAF HEDM program.

DTIC

*Aggregates; Atoms; Cryogenics; Eigenvectors*

**20030011546** Air Force Research Lab., Propulsion Directorate West, Edwards AFB, CA USA

**Electronic Spectroscopy of B Atoms and B<sub>2</sub> Molecules Isolated in Para-H<sub>2</sub>, Normal-D<sub>2</sub>, Ne, Ar, Kr, and Xe Matrices**

Tam, Simon; Macler, Michel; DeRose, Michelle E.; Fajardo, Mario E.; May 15, 2000; 42p; In English

Contract(s)/Grant(s): AF Proj. 2303

Report No.(s): AD-A408930; AFRL-PR-ED-TP-2000-114; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

We report spectroscopic observations on B atoms isolated in cryogenic parahydrogen (pH<sub>2</sub>), normal deuterium (nD<sub>2</sub>), Ne, Ar, Kr, and Xe matrices, and of B<sub>2</sub> molecules in Ne, Ar, Kr, and Xe matrices. The 2s(<sup>2</sup>)3s(<sup>2</sup>)S left arrow 2s(<sup>2</sup>)2p(<sup>2</sup>)P B atom Rydberg absorption suffers large gas-to-matrix blue shifts, increasing from +3000 to +7000/cm in the host sequence: Xe less than Kr less than Ar approx. = Ne approx. = nD(2) approx. = pH<sub>2</sub>. Much smaller shifts are observed for the 2s2p(<sup>2</sup>)D left arrow 2s(<sup>2</sup>)2p(<sup>2</sup>)P B atom core-to-valence transition. We assign pairs of absorption peaks spaced by approx. 10 nm in the 315 to 355 nm region to the B<sub>2</sub> (A (<sup>3</sup>)Sigma (<sub>u</sub>)(-) left arrow X (<sup>3</sup>)Sigma (<sub>g</sub>)(-)) Douglas-Herzberg transition. We assign a much weaker progression in the 260 to 300 nm region to the B<sub>2</sub> (2) (<sup>3</sup>)Pi (<sub>u</sub>) left arrow X (<sup>3</sup>)Sigma (<sub>g</sub>)(-) transition. We report a novel progression of strong peaks in the 180 to 200 nm region which we suspect may be due to B<sub>2</sub> molecules, but which remains unassigned. Ultraviolet (UV) absorption spectra of B/pH<sub>2</sub> solids show two strong peaks at 216.6 and 208.9 nm, which we assign to the matrix perturbed 2s(<sup>2</sup>)3s(<sup>2</sup>)S left arrow 2s(<sup>2</sup>)2p(<sup>2</sup>)P and 2s2p(<sup>2</sup>)D left arrow 2s(<sup>2</sup>)2p(<sup>2</sup>)P B atom absorptions, respectively. Laser induced fluorescence emission spectra of B/pH<sub>2</sub> solids show a single line at 249.6 nm, coincident with the gas phase wavelength of the 2s(<sup>2</sup>)3s(<sup>2</sup>)S right arrow 2s(<sup>2</sup>)2p(<sup>2</sup>)P B atom emission. The UV laser irradiation results in photobleaching of the B atom emission and absorptions, accompanied by the formation of B<sub>2</sub>H<sub>6</sub>.

DTIC

*Absorption Spectra; Boron; Spectroscopy*

## 74 OPTICS

*Includes light phenomena and the theory of optical devices. For lasers see 36 Lasers and Masers.*

**20030007693** Science Applications, Inc., Arlington, VA USA

**On the Transport of Polarized Infrared Signals Through the Terrestrial Atmosphere *Final Report, 15 Apr. 1999-25 Feb. 2002***

Pesses, Mark; Israel, Steven; Meyer, Rodney; Price, Michael J.; Sep. 23, 2002; 80p; In English

Contract(s)/Grant(s): F49620-99-C-0019

Report No.(s): AD-A408175; AFRL-SR-AR-TR-02-0354; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Both the Mie scattering and polarimetric transport models indicate that, in the LWIR, the atmospheric effect on the transport of right-hand circularly polarized signals and left-hand circularly polarized signals is identical. In the LWIR, the observed normalized circular polarization anisotropy, S<sub>3</sub>/S<sub>0</sub>, of a signal should not require any atmospheric corrections. Because natural LWIR light is not circularly polarized, only an active system will be able to exploit this finding. Both the Mie scattering and polarimetric transport models indicate that, in the LWIR, the atmospheric effect on the transport of the two orthogonal components of linearly polarized signals should be significantly different. In the LWIR both the observed degree of lineal polarization and the observed normalized linear polarization anisotropy S<sub>i</sub>/S<sub>0</sub> of a signal should require atmospheric corrections.

DTIC

*Linear Polarization; Infrared Radiation; Earth Atmosphere; Atmospheric Effects; Circular Polarization; Polarimetry*

**20030007701** California Univ., Los Angeles, CA USA

**Advanced High Frequency Communication and Optoelectronic Radar Systems *Final Report, 15 Mar. 2000-14 Mar 2001***

Jul. 15, 2001; 19p; In English

Contract(s)/Grant(s): F49620-00-1-0287

Report No.(s): AD-A408162; AFRL-SR-AR-TR-02-0350; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We have demonstrated photonic time-stretching (PTS) of radio frequency (RF) signals using our novel polymer modulators and two techniques to reduce the power penalty from the effects of fiber chromatic dispersion. A Single-sideband (SSB) modulator configuration has almost eliminated the effect of this penalty without bandwidth limitations. The dsb( DSB) modulator configuration, with an alternative quadrature bias point, has also shown significant improvement of bandwidth limitations for a



given fiber link length. In addition, we have investigated the general characteristics of the power penalty's relation with several modulation schemes.

DTIC

*Optical Radar; Electro-Optics; Radar Equipment; Communication Equipment*

**20030007902** Stanford Univ., High Temperature Gasdynamics Lab., CA USA

**Development and Application of Novel Diagnostics for Arc-Jet Characterization** *Final Report, 1 Apr. 2000 - 30 Sep. 2002*

Hanson, R. K., Stanford Univ., USA; December 2002; 18p; In English; Original contains color illustrations

Contract(s)/Grant(s): NCC2-5377; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This NASA-Ames University Consortium Project has focused on the design and demonstration of optical absorption sensors using tunable diode laser to target atomic copper impurities from electrode erosion in the arc-heater metastable electronic excited states of molecular nitrogen, atomic argon, and atomic oxygen in the arcjet plume. Accomplishments during this project include: 1. Design, construction, and assembly of optical access to the arc-heater gas flow. 2. Design of diode laser sensor for copper impurities in the arc-heater flow. 3. Diode laser sensor design and test in laboratory plasmas for metastable Ar(3P), O(5S), N(4P), and N2(A). 4. Diode laser sensor demonstration measurements in the test cell to monitor species in the arc-jet plume.

Derived from text

*Design Analysis; Fabrication; Arc Heating; Gas Flow; Optical Control; Diodes; Lasers; Copper; Impurities*

**20030010513** Massachusetts Inst. of Tech., Cambridge, MA USA

**Scale Closure in Upper Ocean Optical Properties: From Single Particles to Ocean Color**

Green, Rebecca E.; Jun. 2002; 172p; In English; Original contains color images; --Original contains color plates: All DTIC reproductions will be in black and white. Prepared in cooperation with Woods Hole Oceanographic Institution, MA

Contract(s)/Grant(s): N00014-95-1-0333; N00014-96-1-0965

Report No.(s): AD-A408837; MIT/WHOI-2002-10; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

Predictions of chlorophyll concentration from satellite ocean color are an indicator of primary productivity, with implications for foodwebs, fisheries, and the global carbon cycle. Models describing the relationship between optical properties and chlorophyll do not account for much of the optical variability observed in natural waters, because of the presence of seawater constituents that do not covary with phytoplankton pigments. In order to understand variability in these models, the optical contributions of seawater constituents were investigated. A combination of Mie theory and flow cytometry was used to determine the diameter, complex refractive index, and optical cross-sections of individual particles. In New England continental shelf waters, eukaryotic phytoplankton were the main particle contributors to absorption and scattering. Minerals were the main contributor to backscattering (bb) in the spring, whereas in the summer both minerals and detritus contributed to bb. Synechococcus and heterotrophic bacteria were relatively unimportant optically. Seasonal differences in the spectral shape of remote sensing reflectance, R<sub>rs</sub>, were contributed to approximately equally by eukaryotic phytoplankton absorption, dissolved absorption, and non-phytoplankton bb. Differences between measurements of bb and R<sub>rs</sub> and modeled values based on chlorophyll concentration were caused by higher dissolved absorption and non-phytoplankton bb than were assumed by the model.

DTIC

*Optical Properties; Oceans; Carbon Cycle; Water Color*

**20030011475** L-3 Communications Corp., Mesa, AZ USA

**Integration of a Legacy System with Night Vision Training System (NVTS)** *Final Report, Oct. 2000-Nov. 2001*

Anderson, Gretchen M.; Vrana, Craig A.; Riegler, Joseph T.; Martin, Elizabeth L.; Aug. 2002; 29p; In English; Original contains color images

Contract(s)/Grant(s): F41624-97-D-5000; AF Proj. 4924

Report No.(s): AD-A408580; AFRL-HE-AZ-TR-2002-0069; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The increase in tactical night operations resulted in the requirement for improved night vision goggle (NVG) training and simulation. The Night Vision Training System (NVTS), developed at the Air Force Research Laboratory's Warfighter Training Research Division (AFRL/HEA), provides high-fidelity NVG imagery required to support effective NVG training and mission rehearsal. Acquisition of a multichannel NVTS, to drive both an out-the-window (OTW) view and a helmet-mounted display (HMD), may exceed resources of some training units. An alternative could be to add one channel of NVG imagery to the existing OTW imagery provided by the legacy system. This evaluation addressed engineering and training issues associated with integrating a single NVTS HMD channel with an existing legacy system. Pilots rated the degree of disparity between the HMD and OTW scenes for various scene attributes and effect on flight performance. Findings demonstrated the potential for integration of an NVTS channel with an existing legacy system. Latency and terrain elevation differences between the two databases were

measured and did not significantly impact system integration or pilot ratings. When integrating other legacy systems with NVTs, significant disparities may exist between the two databases. Pilot ratings and comments indicate that (a) display brightness and contrast levels of the OTW scene should be set to correspond to real-world, (b) unaided luminance values for a given illumination condition; disparity in moon phase and position between the two sky models should be minimized; and (c) star quantity and brightness in the OTW scene and the NVG scene, as rendered on the HMD, should be as consistent with real-world conditions as possible.

DTIC

*Night Vision; Computer Graphics; Image Processing; Enhanced Vision*

## 76

### SOLID-STATE PHYSICS

*Includes condensed matter physics, crystallography, and superconductivity. For related information see also 33 Electronics and Electrical Engineering and 36 Lasers and Masers.*

**20030007783** Research Inst. of National Defence, Div. of Sensor Technology, Linköping, Sweden

#### **Manufacture and Evaluation of Polymer Dispersed Liquid Crystal Test Components**

Karlis, H.; Rudquist, P.; D'have, K.; Ekstroem, U.; Nov. 2001; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM.

Report No.(s): PB2003-101023; FOI-R-0247-SE; No Copyright; Avail: National Technical Information Service (NTIS)

Components for protection against laser radiation have been manufactured using orthoconic antiferroelectric liquid crystals. LC droplets were dispersed in an index matched polymer matrix forming a transparent component. When a voltage is applied across the thin component the rod-like molecules are tilted, destroying the index matching. The lack of index matching results in scattering of incoming laser light. The scattering was measured as a function of angle, voltage and temperature. The dynamic properties of the components were analyzed as well as the spectral distribution of the transmitted light in both open and closed states. The results are presented together with suggestions for improvements based on the results and a theoretical model presented.

NTIS

*Liquid Crystals; Evaluation; Manufacturing; Performance Tests; Ferroelectric Materials; Mathematical Models*

**20030007846** NASA Langley Research Center, Hampton, VA USA

#### **Applicability of the Continuum-Shell Theories to the Mechanics of Carbon Nanotubes**

Harik, V. M., NASA Langley Research Center, USA; Gates, T. S., NASA Langley Research Center, USA; Nemeth, M. P., NASA Langley Research Center, USA; [2002]; 11p; In English; 43rd AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials, 22-25 Apr. 2002, Denver, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): NAS1-97046

Report No.(s): AIAA Paper 2002-1429; Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche; Distribution under U.S. Government purpose rights under contract number NAS1-97046; Distribution under U.S. Government purpose rights under contract number NAS1-97046

Validity of the assumptions relating the applicability of continuum shell theories to the global mechanical behavior of carbon nanotubes is examined. The present study focuses on providing a basis that can be used to qualitatively assess the appropriateness of continuum-shell models for nanotubes. To address the effect of nanotube structure on their deformation, all nanotube geometries are divided into four major classes that require distinct models. Criteria for the applicability of continuum models are presented. The key parameters that control the buckling strains and deformation modes of these classes of nanotubes are determined. In an analogy with continuum mechanics, mechanical laws of geometric similitude are presented. A parametric map is constructed for a variety of nanotube geometries as a guide for the applicability of different models. The continuum assumptions made in representing a nanotube as a homogeneous thin shell are analyzed to identify possible limitations of applying shell theories and using their bifurcation-buckling equations at the nano-scale.

Author

*Carbon Nanotubes; Mechanical Properties; Continuum Modeling*

**20030010285** Columbia Univ., New York, NY USA

**Epitaxial Liftoff for Fully Single Crystal Ferroelectric Thin Films *Final Report, 1 Jul. 1998-31 Aug. 2002***

Osgood, Richard M., Jr.; Levy, Miguel; Bakhru, Hassaram; Cross, Eric; Aug. 2002; 11p; In English

Contract(s)/Grant(s): N00173-98-1-G014

Report No.(s): AD-A408609; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

High-frequency signal transmission demands in RF and microwave systems, such as electronic phased-array radar and scanning antennas, call for innovative approaches in materials technology. Outstanding issues in such systems are the fabrication of low-loss, highly tunable capacitive elements made of thin-film ferroelectrics. This program used a new epitaxial liftoff technique developed at Columbia University to reduce high-quality, single-crystal films of ferroelectrics such as strontium titanate (ST), potassium tantalate, KTaO<sub>3</sub> and potassium tantalate niobate (KTN) for use in microwave devices.

DTIC

*Epitaxy; Fabrication; Ferroelectricity; Radio Frequencies; Signal Transmission; Single Crystals; Thin Films*

**20030010445** Air Force Research Lab., Space and Missile Propulsion Div., Edwards AFB, CA USA

**Crystal Structure of CIF<sub>4</sub>+SbF<sub>6</sub><sup>-</sup>, Normal Coordinate Analyses of CIF<sub>4</sub><sup>+</sup>, BrF<sub>4</sub><sup>+</sup>, IF<sub>4</sub><sup>+</sup>, SF<sub>4</sub>, SeF<sub>4</sub>, and TeF<sub>4</sub>, Simple Method for Calculating the Effects of Fluorine Bridging on the Structure, Vibrational Spectra of Ions in a Strongly Interacting Ionic Solid**

Christe, Karl O.; Zhang, Xiongzh; Sheehy, Jeffrey A.; Bau, Robert; Oct. 12, 2000; 53p; In English; Prepared in collaboration with Loker Hydrocarbon Res. Inst. and Dept. of Chemistry, Univ. of Southern California, Los Angeles, CA

Contract(s)/Grant(s): AF Proj. 2303

Report No.(s): AD-A408568; AFRL-PR-ED-TP-2000-193; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The crystal structure of the 1:1 adduct CIF<sub>5</sub>-SbF<sub>5</sub> was determined and contains discrete CIF<sub>4</sub>(+) and SbF<sub>6</sub>(-) ions. The CIF<sub>4</sub>(+) cation has a pseudo-trigonal bipyramidal structure with two longer and more ionic axial bonds and two shorter and more covalent equatorial bonds. The third equatorial position is occupied by a sterically active free valence electron pair of chlorine. The coordination about the chlorine atom is completed by two longer fluorine contacts in the equatorial plane, resulting in the formation of infinite zigzag chains of alternating CIF<sub>4</sub>(+) and cis fluorine bridged SbF<sub>6</sub>(-) ions. Electronic structure calculations were carried out for the isoelectronic series CIF<sub>4</sub>(+), BrF<sub>4</sub>(+), IF<sub>4</sub>(+) and SF<sub>4</sub>, SeF<sub>4</sub>, TeF<sub>4</sub> at the B3LYP, MP2 and CCSD(T) levels of theory and used to revise the previous vibrational assignments and force fields. The discrepancies between the vibrational spectra observed for CIF<sub>4</sub>(+) in CIF<sub>4</sub>(+)-SbF<sub>6</sub>(-) and those calculated for free CIF<sub>4</sub>(+) are largely due to the fluorine bridging that compresses the equatorial F-Cl-F bond angle and increases the barrier towards equatorial-axial fluorine exchange by the Berry mechanism. A computationally simple model, involving CIF<sub>4</sub>(+) and two fluorine bridged HF molecules at a fixed distance as additional equatorial ligands, was used to simulate the bridging in the infinite chain structure and greatly improved the fit between observed and calculated spectra. bridging in the infinite chain structure and greatly improved the fit between observed and calculated spectra.

DTIC

*Crystal Structure; Fluorides; Fluorine; Chlorine; Electric Bridges*

**20030010517** Michigan State Univ., Dept. of Physics and Astronomy, East Lansing, MI USA

**Applications of Nanotubes in Electronic and Nanomechanical Devices *Final Report, 15 Jan. 1999-30 Sep. 2002***

Tomanek, David; Dec. 2002; 155p; In English

Contract(s)/Grant(s): N00014-99-1-0252

Report No.(s): AD-A408921; 61-3541; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

Using a combination of state-of-the-art computational techniques, the proposed research investigates the suitability of nanotubes for application in nanoscale devices. In view of the present and future Navy needs, the research focuses on applications utilizing the unusually high thermal and electrical conductivity, mechanical strength of nanotubes, as well as their potential for energy storage. Our research helps to better understand nanotube properties in case of chemically and structurally modified nanotubes consisting of carbon and boron nitride, including multi-wall systems and peapods, and addresses their hierarchical self-assembly. Emphasis is placed on addressing problems that currently hinder the production and utilization of nanotubes, including their separation by diameter and chirality, and the use of nanotubes to interconnect molecular electronics components among themselves and with present micron-size devices.

DTIC

*Carbon; Boron Nitrides; Nanotubes; Nanostructure Growth; Molecular Electronics*

**20030011409** Alabama Univ., Center for Biophysical Science and Engineering, Birmingham, AL USA

**Commercial Protein Crystal Growth: Protein Crystallization Facility (CPCG-H)**

DeLucas, Lawrence J., Alabama Univ., USA; STS 107 Shuttle Press Kit: Providing 24/7 Space Science Research; Dec. 16, 2002, pp. 88-89; In English; Also announced as 20030011376; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Within the human body, there are thousands of different proteins that serve a variety of different functions, such as making it possible for red blood cells to carry oxygen in our bodies. Yet proteins can also be involved in diseases. Each protein has a particular chemical structure, which means it has a unique shape. It is this three-dimensional shape that allows each protein to do its job by interacting with chemicals or binding with other proteins. If researchers can determine the shape, or shapes, of a protein, they can learn how it works. This information can then be used by the pharmaceutical industry to develop new drugs or improve the way medications work. The NASA Commercial Space Center sponsoring this experiment - the Center for Biophysical Sciences and Engineering at the University of Alabama at Birmingham - has more than 60 industry and academic partners who grow protein crystals and use the information in drug design projects.

Author

*Protein Crystal Growth; Crystallization; Spaceborne Experiments; Aerospace Technology Transfer; Technology Utilization; Drugs*

**20030011411** Northeastern Univ., Center for Advanced Microgravity Materials Processing (CAMMP), Boston, MA USA

**Zeolite Crystal Growth**

STS 107 Shuttle Press Kit: Providing 24/7 Space Science Research; Dec. 16, 2002, pp. 93-94; In English; Also announced as 20030011376; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Zeolites are as hard as rocks but work like sponges. They have a rigid crystalline structure with a network of interconnected tunnels and cages, similar to honeycomb. These tunnels can store chemicals, like fuels, and then release them when the zeolites are heated. The Center for Advanced Microgravity Materials Processing (CAMMP) - one of 17 NASA sponsored Commercial Space Centers - is working to improve zeolite materials for storing hydrogen fuel. The center is also applying zeolite research to detergents, optical cables, gas and vapor detection for environmental monitoring and control, and chemical production techniques that significantly reduce hazardous by-products.

Author

*Crystal Growth; Aerospace Technology Transfer; Technology Utilization; Spaceborne Experiments; Crystallization; Materials Selection; Zeolites*

**20030011416** European Space Agency

**European Space Agency Payloads**

STS 107 Shuttle Press Kit: Providing 24/7 Space Science Research; Dec. 16, 2002, pp. 102-103; In English; Also announced as 20030011376; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The objective of the Advanced Protein Crystallization Facility (APCF) is to grow large, well ordered crystals of different proteins and viruses for analysis and characterization using a crystallization facility. Operations are fully automated with minimal crew interaction. The goal for the Facility for Adsorption and Surface Tension is to measure the response of surface tension to carefully controlled dynamic changes in the surface area of bubbles or droplets using a multi-user facility. Operations are fully automated with minimal crew interaction. The BIOPACK experiment is a fully automated, multi-user facility that provides capability to conduct biological experiments under varying gravity conditions using two standard facility containers. Facility includes an incubator with three centrifuges, a cooler and a freezer.

Author

*Aerospace Technology Transfer; Technology Utilization; Spaceborne Experiments; Space Shuttle Payloads; European Space Agency; Protein Crystal Growth; Interfacial Tension*

**20030011418** National Space Development Agency, Japan

**National Space Development Agency of Japan (NASDA) Space Experiment Project**

STS 107 Shuttle Press Kit: Providing 24/7 Space Science Research; Dec. 16, 2002, pp. 115-119; In English; Also announced as 20030011376; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

The National Space Development Agency of Japan (NASDA) will implement protein crystal growth experiments for about 16 days on space shuttle mission STS-107 prior to actual utilization of the Japanese Experiment Module (JEM) 'KIBO.' Biological fundamental research experiments and experiments on medical applied research for pharmaceuticals will be conducted with the Commercial Macromolecular Protein Crystal Growth (CMPCG) equipment. NASDA is also providing an opportunity for a space education program in protein crystal growth for high school students. In addition, the Biospecimen Sharing Program (BSP) will



clarify the effects of space on living organisms using rodents carried aboard the space shuttle in the Animal Enclosure Module (AEM). The experiments using the space environment will produce significant results for protein research and the BSP.

Author

*Spaceborne Experiments; Protein Crystal Growth; Aerospace Technology Transfer; Technology Utilization; Aerospace Medicine; Research and Development*

**20030011478** Columbia Univ., New York, NY USA

**New Techniques for Heterogeneous Integration for Sensing Systems** *Final Report, 15 Nov. 1998-14 Nov 2001*

Osgood, Richard M., Jr.; Sep. 11, 2002; 11p; In English

Contract(s)/Grant(s): F49620-99-1-0038

Report No.(s): AD-A408833; AFRL-SR-AR-TR-02-0399; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The program's objective was to develop design and fabrication techniques for integrated optical/microwave RF systems and mid-IR optical waveguide components. Research in the areas of specific integrated optical systems and has yielded the development of the crystal ion slicing (CIS) technique for single-crystal LiNbO<sub>3</sub> films for integrated photonics applications. We have also demonstrated second harmonic generation in these lithium niobate films, direct bonding of metal oxides films onto semiconductor substrates, and a new capability in the beam propagation method simulation of integrated photonic devices.

DTIC

*Infrared Radiation; Lithium Niobates; Metal Bonding; Semiconductors (Materials); Radio Frequencies; Single Crystals*

**20030011507** Air Force Research Lab., Propulsion Directorate West, Edwards AFB, CA USA

**Crystal Structure of Hexamethylguanidinium Hexafluorosilicate Hexahydrate**

Zhang, Xiongzi; Bau, Robert; Sheehy, Jeffrey A.; Christe, Karl O.; Mar. 05, 1999; 20p; In English; Prepared in cooperation with Loker Hydrocarbon Research Institute, University of Southern California, Los Angeles, CA

Contract(s)/Grant(s): AF Proj. 2303

Report No.(s): AD-A408584; AFRL-PR-ED-TP-FY99-0053; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Single crystals of the hexamethylguanidinium hexafluorosilicate hexahydrate salt, C(NMe<sub>2</sub>)<sub>3</sub>(+)(SiF<sub>6</sub>(2-))·6H<sub>2</sub>O, were isolated when a product, obtained by water removal from aqueous C(NMe<sub>2</sub>)<sub>3</sub>F in a glass vessel, was recrystallized from CH<sub>3</sub>OH. The crystal structure of this salt was determined, and the structure of the free hexamethylguanidinium cation was calculated, showing that the propeller-shaped structure of the hexamethylguanidinium cation is not caused by solid state effects but is the true minimum energy structure.

DTIC

*Fluorine Compounds; Electronic Structure; X Ray Analysis; Single Crystals; Salts*

## 77

### PHYSICS OF ELEMENTARY PARTICLES AND FIELDS

*Includes quantum mechanics; theoretical physics; and statistical mechanics. For related information see also 72 Atomic and Molecular Physics, 73 Nuclear Physics, and 25 Inorganic, Organic and Physical Chemistry.*

**20030007715** California Univ., Lawrence Berkeley National Lab., Berkeley, CA USA

**Electrodynamics at the Highest Energies**

Klein, S. R.; Dec. 13, 2001; In English; This document is color dependent and/or in landscape layout. It is currently only available on CD-ROM

Report No.(s): DE2002-801959; No Copyright; Avail: National Technical Information Service (NTIS)

At very high energies, the bremsstrahlung and pair production cross sections exhibit complex behavior due to the material in which the interactions occur. The cross sections in dense media can be dramatically different than for isolated atoms. This write up discusses these in-medium effects, emphasizing how the cross section has different energy and target density dependencies in different regimes. Data from SLAC experiment E-146 will be presented to confirm the energy and density scaling. Finally, QCD analogs of the electrodynamics effects will be discussed.

NTIS

*Electrodynamics; Bremsstrahlung; High Energy Electrons; Pair Production*

**20030010453** Air Force Research Lab., Kirkland AFB, NM USA

**Magnetically Tuned Wide-Band Quantum Well Infrared Photodetectors**

Huang, Danhong; Lyo, S. K.; Jan. 08, 1998; 10p; In English

Contract(s)/Grant(s): Proj-2305

Report No.(s): AD-A408661; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The electron eigenstates of double quantum well system in an in-plane magnetic field are calculated accurately using the density-functional theory, which includes the Coulomb interaction between electrons. The absorption coefficient as a function of the probe photon energy is further calculated using the self-consistent-field theory, which takes into account many-body effects on the optical intersubband transitions. The dependence of the absorption spectra on the magnetic field, temperature, electron density, well and middle-barrier widths, quantum-well symmetry, and electric field has been studied extensively. It provides an unconventional approach for designing a tunable wide-band quantum well infrared photodetectors by applying an in-plane magnetic field.

DTIC

*Broadband; Infrared Radiation; Magnetic Fields; Photometers; Quantum Wells; Electron Density (Concentration)*

**20030010477** Raytheon Co., Electronic Systems Div., Tewksbury, MA USA

**Diamond Microchannel Heat Sink Designs For High Heat Flux Thermal Control**

Corbin, Michael V.; DeBenedictis, Matthew M.; James, David B.; LeBlanc, Stephen P.; Paradis, Leo R.; Aug. 2002; 13p; In English; Original contains color images; See Also ADM201460. Papers from Unclassified Proceedings from the 11th Annual AAIA/MDA Technology Conference held in Monterey, CA from 29 Jul - 2 Aug 2002., The original document contains color images

Report No.(s): AD-A408712; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Directed energy weapons, wide band gap semiconductor based radars, and other powerful systems present significant thermal control challenges to component designers. Heat flux levels approaching 2000 W/cm<sup>2</sup> are encountered at the base of laser diodes, and levels as high as 500 W/cm<sup>2</sup> are expected in laser slabs and power amplifier tube collectors. These impressive heat flux levels frequently combine with strict operating temperature requirements to further compound the thermal control problem. Many investigators have suggested the use of diamond heat spreaders to reduce flux levels at or near to its source, and some have suggested that diamond microchannel heat sinks ultimately may play a significant role in the solution of these problems. Design engineers at Raytheon Company have investigated the application of all-diamond microchannel heat sinks to representative high heat flux problems and have found the approach promising. Diamond microchannel fabrication feasibility has been demonstrated; integration into packaging systems and the accompanying material compatibility issues have been addressed; and thermal and hydrodynamic performance predictions have been made for selected, possible applications. An example of a practical, all diamond microchannel heat sink has been fabricated, and another is in process and will be performance tested. The heat sink assembly is made entirely of optical quality, CVD diamond and is of sufficient strength to withstand the thermal and pressure-induced mechanical loads associated with manufacture and use in tactical weapons environment. The work presented describes the development program's accomplishments to date, and highlights many of the areas for future study.

DTIC

*Heat Flux; Heat Sinks; Microchannels; Temperature Control*

**20030011251** Army Engineer Research and Development Center, Environmental Lab., Vicksburg, MS USA

**Tree Canopy Characterization for EO-1 Reflective and Thermal Infrared Validation Studies: Rochester, New York Final Report**

Ballard, Jerrell R., Jr.; Smith, James A.; Sep. 2002; 38p; In English; Original contains color images

Report No.(s): AD-A408688; ERDC/EL-TR-02-33; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The tree canopy characterization presented herein provided ground and tree canopy data for different types of tree canopies in support of EO-1 reflective and thermal infrared validation studies. These characterization efforts during August and September of 2001 included stem and trunk location surveys, tree structure geometry measurements, meteorology, and leaf area index (LAI) measurements. Measurements were also collected on thermal and reflective spectral properties of leaves, tree bark, leaf litter, soil, and grass. The data presented in this report were used to generate synthetic reflective and thermal infrared scenes and images that were used for the EO-1 Validation Program. The data also were used to evaluate whether the EO-1 ALI reflective channels can be combined with the LANDSAT-7 ETM+ thermal infrared channel to estimate canopy temperature, and also test the effects of separating the thermal and reflective measurements in time resulting from satellite formation flying.

DTIC

*Mathematical Models; Infrared Radiation; Canopies (Vegetation); Trees (Plants); Thermodynamic Properties*

## SOCIAL AND INFORMATION SCIENCES (GENERAL)

*Includes general research topics related to sociology; educational programs and curricula.*

**20030007908** University of Electro-Communications, Dept. of Systems Engineering, Tokyo, Japan

### **Relationship between the Demand to Improve the Quality of Education in Universities, and the Paths Students Choose to Follow and Their Motivation to Learn**

Komiyama, Kazuhiko, University of Electro-Communications, Japan; Hiraku, Yoichi, University of Electro-Communications, Japan; Tsubaki, Michiko, University of Electro-Communications, Japan; Bulletin of the University of Electro-Communications; July 2002; ISSN 0915-0935; Volume 15, No. 1 (Serial No. 29), pp. 1-13; In Japanese; Copyright; Avail: Issuing Activity

In recent years, there have been many discussions about improving the quality of education in universities. In terms of quality system engineering, Akao and Nagai discussed that improving the quality of education in universities cannot be achieved in the same manner as the improvement of the quality of products. This is because in the case of products, the people who require improvement of products and improved products themselves are not the same entity; however, in the case of education, the people who require improvement of the quality of education are the people who would benefit from this improvement. Therefore, when we investigate the demand for improving the quality of education, it is necessary to use a method in which the relationship between the demand for improvement, and the paths the students choose to follow as well as their motivation to learn is clarified. However, in practice, in questionnaires conducted to elucidate the demand for improving the quality of education, questions similar to those used in the case of product improvement studies have often been used. In this study, we attempted to design questionnaires which enable us to analyze the effect of the differences in paths and motivations on the demand for improvement. by conducting a detailed analysis of students who have chosen different paths and of students who have different levels of motivation to learn, this study enables more precise understanding of the demand for improving the quality of university education.

Author

*Education; Students; Universities; Quality; Surveys; Improvement*

## ADMINISTRATION AND MANAGEMENT

*Includes management planning and research.*

**20030007689** General Accounting Office, Washington, DC USA

### **Performance and Accountability: Reported Agency Actions and Plans to Address 2001 Management Challenges and Program Risks**

Oct. 2002; 202p

Report No.(s): PB2003-101787; GAO-03-225; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

In January 2001, GAO issued its special series of reports entitled the Performance and Accountability Series: Major Management Challenges and Program Risks which described major management challenges and high risk areas facing 21 federal agencies. This report describes both agency-specific challenges and two government-wide high-risk areas strategic human capital management and information security that were identified in our January 2001 reports and how agencies have reported responding to these challenges.

NTIS

*Management; Management Information Systems; Risk; Security; Governments*

**20030007804** Department of Education, Washington, DC USA

### **Guide to Continuous Improvement Management (CIM) for 21st Century Community Learning Centers**

Feb. 1999; 106p

Report No.(s): PB2003-101474; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Principles of Continuous Improvement Management (CIM): 1. Customer-Driven Services: Identify customer expectations and requirements and strive to continually meet or exceed them. 2. Core Activities: Identify the central ways in which your program meets customer needs; these are your priorities. 3. Data-Driven Monitoring: Use data to help monitor progress and solve problems-early. Turn what might have been obstacles into achievements. 4. Inclusive Partnership: Involve your customers and stakeholders in decision-making (although not all in the same way) and work toward joint objectives with the schools and the

community. 5. Continuous Improvement: Strive to continuously improve your program through ongoing measurement of what you do and what you accomplish. Constantly ask yourself, 'How can I make my program even better.'

NTIS

*Management; Performance Prediction; Evaluation*

## 82

### DOCUMENTATION AND INFORMATION SCIENCE

*Includes information management; information storage and retrieval technology; technical writing; graphic arts; and micrography. For computer documentation see 61 Computer Programming and Software.*

**20030007710** President's Information Technology Advisory Committee, Washington, DC USA

**Digital Libraries: Universal Access to Human Knowledge. Report to the President**

Feb. 2001; 32p; In English

Report No.(s): PB2003-101772; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Over the past year, the Presidents Information Technology Advisory Committee (PITAC) has focused much of its attention on providing a vision for information technology role in driving progress in the 21st century, particularly progress in education and human development for all citizens. One of two PITAC panels focusing on educational issues examined the status of digital libraries the networked collections of digital text, documents, images, sounds, scientific data, and software that are the core of todays Internet and tomorrows universally accessible digital repositories of all human knowledge. We are especially proud of this report, Digital Libraries: Universal Access to Human Knowledge, because of the profound relevance of this technology to advancing quality education in every school, learning center, and home in the country.

NTIS

*Libraries; Information Systems; Digital Data; Presidential Reports*

**20030010352** Sonic Foundry, Pittsburgh, PA USA

**Intelligent Analyst Digital Video Library Prototype Final Report, Aug. 1998-Jan. 2002**

Ghai, Manju; Oct. 2002; 38p; In English; Original contains color images

Contract(s)/Grant(s): F30602-98-2-0284; AF Proj. 459E

Report No.(s): AD-A408507; AFRL-IF-RS-TR-2002-286; No Copyright; Avail: Defense Technical Information Center (DTIC)

This report provides details on the Intelligence Analyst Digital Video Library Prototype that was developed to incorporate various methods, techniques, and technology into a video indexing and retrieval system to enable Intelligence Analysts to more easily and effectively perform their jobs when exploiting video. It incorporated various automatic and user assisted indexing methods such as geoposition (GPS (Global Positioning System)), moving object detection, and analyst annotations, date/ time, etc.

DTIC

*Digital Systems; Video Signals*

**20030010442** National Archives and Records Service, Office of the Federal Register, Washington, DC USA

**Records Management Guidance for Agencies Implementing Electronic Signature Technologies**

Oct. 18, 2000; 22p; In English

Report No.(s): AD-A408512; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Government Paperwork Elimination Act (GPEA, P.L. 105-277) requires that, when practicable, Federal agencies use electronic forms, electronic filing, and electronic signatures to conduct official business with the public by 2003. In doing this, agencies will create records with business, legal and, in some cases, historical value. This guidance focuses on records management issues involving records that have been created using electronic signature technology. It supplements the Office of Management end budget (OMB) guidance for agencies implementing the GPEA, as well as other National Archives and Records Administration (NARA) guidance.

DTIC

*Records Management; Papers*

**20030011347** Naval Postgraduate School, Monterey, CA USA

**Summary of Research 2000, Department of Systems Management**

Euske, Kenneth J.; Liao, Shu S.; Dec. 2001; 136p; In English

Report No.(s): AD-A408860; NPS-09-02-010; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche



This report contains project summaries of the research projects in the Department of Systems Management. A list of recent publications is also included, which consists of conference presentations and publications, books, contributions to books, published journal papers, and technical reports. Thesis abstracts of students advised by faculty in the Department are also included. The mission of the Department is: to improve the managerial capabilities and leadership qualities of US and international officers and government civilians through graduate education, research, and professional service. to develop students' abilities to analyze, think critically, and take intelligent action so they can more effectively carry out their professional responsibilities, and lead their organizations in complex, and sometimes life-threatening, environment. to conduct research that supports military decision-making, problem solving, and policy setting, improves administrative processes and organizational effectiveness, contributes knowledge to academic disciplines, and advances the mission of graduate education, and to provide professional expertise that supports the development of the Naval Postgraduate School, the Departments of Navy and Defense, and other branches of Government, as well as our professional and academic organizations.

DTIC

*Abstracts; Systems Management; Military Technology; Research and Development*

## 89 ASTRONOMY

*Includes observations of celestial bodies, astronomical instruments and techniques; radio, gamma-ray, x-ray, ultraviolet, and infrared astronomy; and astrometry.*

**20030007850** Space Research Organization Netherlands, Lab. for Space Research, Utrecht, Netherlands

**XMM-Newton Observations of the Cluster of Galaxies Sersic 159-03**

Kaastra, J. S., Space Research Organization Netherlands, Netherlands; Ferrigno, C., Space Research Organization Netherlands, Netherlands; Tamura, T., Space Research Organization Netherlands, Netherlands; Paerels, F. B. S., Columbia Univ., USA; Peterson, J. R., Columbia Univ., USA; Mittaz, J. P. D., Mullard Space Science Lab., UK; Oct. 02, 2000; 5p; In English  
Contract(s)/Grant(s): NAS5-31429; Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

The cluster of galaxies Sersic 159-03 was observed with the XMM-Newton X-ray observatory as part of the Guaranteed Time program. X-ray spectra taken with the EPIC and RGS instruments show no evidence for the strong cooling flow derived from previous X-ray observations. There is a significant lack of cool gas below 1.5 keV as compared to standard isobaric cooling flow models. While the oxygen is distributed more or less uniformly over the cluster, iron shows a strong concentration in the center of the cluster, slightly offset from the brightness center but within the central cD galaxy. This points to enhanced type Ia supernova activity in the center of the cluster. There is also an elongated iron-rich structure extending to the east of the cluster, showing the inhomogeneity of the iron distribution. Finally, the temperature drops rapidly beyond 4' from the cluster center.

Author

*Galactic Clusters; X Ray Spectra; Cold Gas; Supernovae*

**20030007851** Columbia Univ., Columbia Astrophysics Lab., New York, NY USA

**First XMM-Newton Observations of an Isolated Neutron Star: RXJ0720.4-3125**

Paerels, Frits, Columbia Univ., USA; Mori, Kaya, Columbia Univ., USA; Motch, Christian, Centre National de la Recherche Scientifique, France; Haberl, Frank, Max-Planck-Inst. fuer Extraterrestrische Physik, Germany; Zavlin, Vyacheslav E., Max-Planck-Inst. fuer Extraterrestrische Physik, Germany; Zane, Silvia, Mullard Space Science Lab., UK; Ramsay, Gavin, Mullard Space Science Lab., UK; Cropper, Mark, Mullard Space Science Lab., UK; Oct. 02, 2000; 4p; In English  
Contract(s)/Grant(s): NAS5-31429; Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

We present the high resolution spectrum of the isolated neutron star RXJ0720.4-3125, obtained with the Reflection Grating Spectrometer on XMM-Newton, complemented with the broad band spectrum observed with the EPIC PN camera. The spectrum appears smooth, with no evidence for strong photospheric absorption or emission features. We briefly discuss the implications of our failure to detect structure in the spectrum.

Author

*High Resolution; Neutron Stars; Neutrons; Spectra; Observation*

**20030007852** NASA Goddard Space Flight Center, Greenbelt, MD USA

**X-Ray Spectroscopy of the Cluster of Galaxies Abell 1795 with XMM-Newton**

Tamura, T., Space Research Organization Netherlands, Netherlands; Kaastra, J. S., Space Research Organization Netherlands, Netherlands; Peterson, J. R., Space Research Organization Netherlands, Netherlands; Paerels, F., Space Research Organization Netherlands, Netherlands; Mittaz, J. P. D., Mullard Space Science Lab., UK; Trudolyubov, S. P., Los Alamos National Lab., USA; Stewart, G., Leicester Univ., UK; Fabian, A. C., Institute of Astronomy, UK; Mushotzky, R. F., NASA Goddard Space Flight Center, USA; Lumb, D. H., European Space Agency. European Space Research and Technology Center, ESTEC, Netherlands; Oct. 03, 2000; 6p; In English

Contract(s)/Grant(s): NAS5-31429; Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

The initial results from XMM-Newton observations of the rich cluster of galaxies Abell 1795 are presented. The spatially-resolved X-ray spectra taken by the European Photon Imaging Cameras (EPIC) show a temperature drop at a radius of  $\sim 200$  kpc from the cluster center, indicating that the ICM is cooling. Both the EPIC and the Reflection Grating Spectrometers (RGS) spectra extracted from the cluster center can be described by an isothermal model with a temperature of approx. 4 keV. The volume emission measure of any cool component (less than 1 keV) is less than a few % of the hot component at the cluster center. A strong O VIII Lyman alpha line was detected with the RGS from the cluster core. The O abundance of the ICM is 0.2-0.5 times the solar value. The O to Fe ratio at the cluster center is 0.5 - 1.5 times the solar ratio.

Author

*X Ray Spectroscopy; Galactic Clusters; Lyman Alpha Radiation*

**20030007853** Columbia Univ., Columbia Astrophysics Lab., New York, NY USA

**The X-Ray Spectrum of the Supernova Remnant 1E 0102-72.3**

Rasmussen, Andrew P., Columbia Univ., USA; Behar, Ehud, Columbia Univ., USA; Kahn, Steven M., Columbia Univ., USA; denHerder, Jan Willem, Utrecht Univ., Netherlands; vanderHeyden, Kurt, Utrecht Univ., Netherlands; Mar. 16, 1997; 5p; In English

Contract(s)/Grant(s): NAS5-31429; Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

In this letter we present the soft X-ray (5-35A) spectrum of the supernova remnant (SNR) 1E 0102-72.3 in the Small Magellanic Cloud, acquired by the reflection grating spectrometer (RGS) aboard ESA's XMM-Newton Observatory. This extended-source X-ray spectrum of unprecedented spectral resolution ( $\lambda/\Delta\lambda$  approx. 300) permits, for the first time, unambiguous identification and measurement of isolated emission lines and line complexes alike. The diagnostic power of performing spectroscopy using groups of emission lines from single ions is exemplified. In particular, the bright Lyman and helium series lines for light elements (C VI, O VII, O VIII, Ne IX, Ne X and possibly Mg XI & Mg XII) show peculiar ratios, where the values  $[1s - np] / [1s - (n+1)p]$  are systematically weaker than expected for electron impact excitation. These measured ratios resemble signatures of recombining or charge exchanging plasmas. We argue that charge exchange, given its large cross section and evidence for inhomogeneous media within the SNR, is a likely mechanism for the observed emission. Also, the well known temperature diagnostics  $G(T_{\text{sub e}}) = (i + f)/r$  of helium-like triplets (O VII & Ne IX) indicate high temperatures, well above the maximum emission temperature  $T_{\text{sub m}}$  for each ion, and consistent with a purely ionizing plasma. The density diagnostics  $R(n_{\text{sub e}}) = f / i$  meanwhile, are consistent with the low density limit, as expected.

Author

*X Rays; Spectral Resolution; Emission Spectra; Supernova Remnants; Light Elements; Magellanic Clouds*

**20030007854** NASA Goddard Space Flight Center, Greenbelt, MD USA

**UV Observations of the Galaxy Cluster Abell 1795 with the Optical Monitor on XMM-Newton**

Mittaz, J. P. D., Mullard Space Science Lab., UK; Kaastra, J. S., Space Research Organization Netherlands, Netherlands; Tamura, T., Space Research Organization Netherlands, Netherlands; Fabian, A. C., Institute of Astronomy, UK; Mushotzky, R. F., NASA Goddard Space Flight Center, USA; Peterson, J. R., Columbia Univ., USA; Ikebe, Y., Max-Planck-Institut für Extraterrestrische Physik, Germany; Lumb, D. H., European Space Agency. European Space Research and Technology Center, ESTEC, Netherlands; Paerels, F., Columbia Univ., USA; Stewart, G., Leicester Univ., UK; Oct. 01, 2000; 6p; In English

Contract(s)/Grant(s): NAS5-31429; Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

We present the results of an analysis of broad band UV observations of the central regions of Abell 1795 observed with the optical monitor on XMM-Newton. As have been found with other UV observations of the central regions of clusters of galaxies, we find evidence for star formation. However, we also find evidence for absorption in the cD galaxy on a more extended scale

than has been seen with optical imaging. We also report the first UV observation of part of the filamentary structure seen in H-alpha, X-rays and very deep U band imaging. The part of the filament we see is very blue with UV colours consistent with a very early (O/B) stellar population. This is the first direct evidence of a dominant population of early type stars at the centre of Abell 1795 and implies very recent star formation. The relationship of this emission to emission at other wavebands is discussed.

Author

*Galactic Clusters; Ultraviolet Emission; Imaging Techniques; X Rays*

**20030007856** Columbia Univ., Columbia Astrophysics Lab., New York, NY USA

**High Resolution X-Ray Spectroscopy and Imaging of Supernova Remnant N132D**

Behar, Ehud, Columbia Univ., USA; Rasmussen, Andrew, Columbia Univ., USA; Griffiths, R. Gareth, Leicester Univ., UK; Dennerl, Konrad, Max-Planck-Inst. fuer Extraterrestrische Physik, Germany; Audard, Marc, Paul Scherrer Inst., Switzerland; Aschenbach, Bernd, Max-Planck-Inst. fuer Extraterrestrische Physik, Germany; Oct. 01, 2000; 5p; In English

Contract(s)/Grant(s): NAS5-31429; Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

The observation of the supernova remnant N132D by the scientific instruments on board the XMM-Newton satellite is presented. The X-rays from N132D are dispersed into a detailed line-rich spectrum using the Reflection Grating Spectrometers. Spectral lines of C, N, O, Ne, Mg, Si, S, and Fe are identified. Images of the remnant, in narrow wavelength bands, produced by the European Photon Imaging Cameras reveal a complex spatial structure of the ionic distribution. While K - shell Fe seems to originate near the centre, all of the other ions are observed along the shell. An emission excess of O(6+) over O(7+) is detected on the northeastern edge of the remnant. This can be a sign of hot ionising conditions, or it can reflect a relatively cool region. Spectral fitting of the CCD spectrum suggests high temperatures in this region, but a detailed analysis of the atomic processes involved in producing the O(6+) spectral lines leads to the conclusion that the intensities of these lines alone cannot provide a conclusive distinction between the two scenarios.

Author

*High Resolution; X Ray Spectroscopy; Imaging Techniques; Supernova Remnants; Line Spectra*

**20030007857** Space Research Organization Netherlands, Lab. for Space Research, Utrecht, Netherlands

**Detection of X-Ray Line Emission from the Shell of SNR B0540-69.3 with XMM-Newton RGS**

vanderHeyden, K. J., Space Research Organization Netherlands, Netherlands; Cottam, J., Columbia Univ., USA; Paerels, F., Columbia Univ., USA; Kaastra, J. S., Space Research Organization Netherlands, Netherlands; Branduardi-Raymont, G., Mullard Space Science Lab., UK; Oct. 03, 2000; 5p; In English

Contract(s)/Grant(s): NAS5-31429; Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

We present X-ray observations of PSR 0540-69.3 with the XMM-Newton observatory. The spectra obtained with the Reflection Grating Spectrometer reveal, for the first time, emission from ionized species of O, Ne and Fe originating from the SNR shell. Analysis of the emission line spectrum allows us to derive estimates of the temperature, ionization timescale, abundances, location, and velocity of the emitting gas.

Author

*Emission Spectra; X Rays; Line Spectra; Supernovae*

**20030007858** Mullard Space Science Lab., Dorking, UK

**First XMM-Newton Observations of a Cataclysmic Variable II: Spectral Studies of OY Car**

Ramsay, Gavin, Mullard Space Science Lab., UK; Cordova, France, California Univ., USA; Cottam, Jean, Columbia Univ., USA; Mason, Keith, Mullard Space Science Lab., UK; Much, Rudu, European Space Agency. European Space Research and Technology Center, ESTEC, Netherlands; Osborne, Julian, Leicester Univ., UK; Pandel, Dirk, California Univ., USA; Poole, Tracey, Mullard Space Science Lab., UK; Wheatley, Peter, Leicester Univ., UK; Sep. 26, 2000; 6p; In English

Contract(s)/Grant(s): NAS5-31429; Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

We present XMM-Newton X-ray spectra of the disc accreting cataclysmic variable OY Car, which were obtained during the performance verification phase of the mission. These data were taken 4 days after a short outburst. In the EPIC spectra we find strong Iron K(beta) emission with weaker Iron K(alpha) emission together with Silicon and Sulphur lines. The spectra are best fitted with a three temperature plasma model with a partial covering absorber. Multiple temperature emission is confirmed by the

emission lines seen in the RGS spectrum and the H/He like intensity ratio for Iron and Sulphur which imply temperatures of approx. 7keV and approx. 3keV respectively.

Author

*Accretion Disks; Binary Stars; Cataclysmic Variables; Emission Spectra*

**20030007860** NASA Goddard Space Flight Center, Greenbelt, MD USA

**X-Ray Imaging-Spectroscopy of Abell 1835**

Peterson, J. R., Columbia Univ., USA; Paerels, F. B. S., Columbia Univ., USA; Kaastra, J. S., Space Research Organization Netherlands, Netherlands; Arnaud, M., Commissariat à l'Energie Atomique, France; Reiprich T. H., Max-Planck-Inst. fuer Extraterrestrische Physik, Germany; Fabian, A. C., Institute of Astronomy, UK; Mushotzky, R. F., NASA Goddard Space Flight Center, USA; Jernigan, J. G., California Univ., USA; Sakelliou, I., Mullard Space Science Lab., UK; Sep. 29, 2000; 6p; In English Contract(s)/Grant(s): NAS5-31429; Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

We present detailed spatially-resolved spectroscopy results of the observation of Abell 1835 using the European Photon Imaging Cameras (EPIC) and the Reflection Grating Spectrometers (RGS) on the XMM-Newton observatory. Abell 1835 is a luminous ( $10(\exp 46)\text{ergs/s}$ ), medium redshift ( $z = 0.2523$ ), X-ray emitting cluster of galaxies. The observations support the interpretation that large amounts of cool gas are present in a multi-phase medium surrounded by a hot ( $kT(\text{sub e}) = 8.2\text{ keV}$ ) outer envelope. We detect O VIII Ly(alpha) and two Fe XXIV complexes in the RGS spectrum. The emission measure of the cool gas below  $kT(\text{sub e}) = 2.7\text{ keV}$  is much lower than expected from standard cooling-flow models, suggesting either a more complicated cooling process than simple isobaric radiative cooling or differential cold absorption of the cooler gas.

Author

*X Ray Imagery; Spectroscopy; Galactic Clusters; Cold Gas; Imaging Techniques*

**20030007861** Columbia Univ., Columbia Astrophysics Lab., New York, NY USA

**A High Resolution Spectroscopic Observation of CAL 83 with XMM-Newton/RGS**

Paerels, Frits, Columbia Univ., USA; Rasmussen, Andrew P., Columbia Univ., USA; Hartmann, H. W., Space Research Organization Netherlands, Netherlands; Heise, J., Space Research Organization Netherlands, Netherlands; Brinkman, A. C., Space Research Organization Netherlands, Netherlands; deVries, C. P., Space Research Organization Netherlands, Netherlands; denHerder, J.-W., Space Research Organization Netherlands, Netherlands; Oct. 02, 2000; 4p; In English Contract(s)/Grant(s): NAS5-31429; Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

We present the first high resolution photospheric X-ray spectrum of a Supersoft X-ray Source, the famous CAL 83 in the Large Magellanic Cloud. The spectrum was obtained with the Reflection Grating Spectrometer on XMM-Newton during the Calibration/Performance Verification phase of the observatory. The spectrum covers the range 20-40 Å at an approximately constant resolution of 0.05 Å, and shows very significant, intricate detail, that is very sensitive to the physical properties of the object. We present the results of an initial investigation of the spectrum, from which we draw the conclusion that the spectral structure is probably dominated by numerous absorption features due to transitions in the G-shells of the mid-2 elements and the M-shell of Fe, in addition to a few strong K-shell features due to CNO.

Author

*Spectroscopy; X Ray Sources; Magellanic Clouds; High Resolution*

**20030007879** Space Research Organization Netherlands, Utrecht, Netherlands

**First Light Measurements with the XMM-Newton Reflection Grating Spectrometers: Evidence for an Inverse First Ionization Potential Effect and Anomalous Ne Abundance in the Coronae of HR 1099**

Brinkman, A. C., Space Research Organization Netherlands, Netherlands; Behar, E., Columbia Univ., USA; Guedel, M., Paul Scherrer Inst., Switzerland; Audard, M., Paul Scherrer Inst., Switzerland; denBoggende, A. J. F., Space Research Organization Netherlands, Netherlands; Branduardi-Raymont, G., Mullard Space Science Lab., UK; Cottam, J., Columbia Univ., USA; Erd, C., European Space Agency. European Space Research and Technology Center, ESTEC, Netherlands; denHerder, J. W., Space Research Organization Netherlands, Netherlands; Jensen, F., European Space Agency. European Space Research and Technology Center, ESTEC, Netherlands; Oct. 02, 2000; 5p; In English Contract(s)/Grant(s): NAS5-31429; Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

The RS CVn binary system HR 1099 was extensively observed by the XMM-Newton observatory in February 2000 as its first-light target. A total of 570 ks of exposure time was accumulated with the Reflection Grating Spectrometers (RGS). The



integrated X-ray spectrum between 5-38Å is of unprecedented quality and shows numerous features attributed to transitions of the elements C, N, O, Ne, Mg, Si, S, Fe, Ni, and probably others. We perform an in-depth study of the elemental composition of the average corona of this system, and find that the elemental abundances strongly depend on the first ionisation potential (FIP) of the elements. But different from the solar coronal case, we find an inverse FIP effect, i.e., the abundances (relative to oxygen) increase with increasing FIP. Possible scenarios, e.g., selective enrichment due to Ne-rich flare-like events, are discussed.

Author

*Light (Visible Radiation); Measurement; X Rays; Spectra; Solar Corona; Ionization Potentials; Chemical Composition*

**20030007910** Mullard Space Science Lab., Dorking, UK

**Soft X-Ray Emission Lines from a Relativistic Accretion Disk in MCG -6-30-15 and Mrk 766**

Branduardi-Raymont, G., Mullard Space Science Lab., UK; Sako, M., Columbia Univ., USA; Kahn, S. M., Columbia Univ., USA; Brinkman, A. C., Space Research Organization Netherlands, Netherlands; Kaastra, J. S., Space Research Organization Netherlands, Netherlands; Page, M. J., Mullard Space Science Lab., UK; Sep. 29, 2000; 6p; In English

Contract(s)/Grant(s): NAS5-31429; Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

XMM-Newton Reflection Grating Spectrometer (RGS) spectra of the Narrow Line Seyfert 1 galaxies MCG -6-30-15 and Mrk 766 are physically and spectroscopically inconsistent with standard models comprising a power-law continuum absorbed by either cold or ionized matter. We propose that the remarkably similar features detected in both objects in the 5 - 35 Å band are H-like oxygen, nitrogen, and carbon emission lines, gravitationally redshifted and broadened by relativistic effects in the vicinity of a Kerr black hole. We discuss the implications of our interpretation, and demonstrate that the derived parameters can be physically self-consistent.

Author

*X Ray Irradiation; Line Spectra; Relativistic Effects; Extraterrestrial Matter; Emission Spectra; Black Holes (Astronomy)*

**20030007911** Max-Planck-Inst. fuer Extraterrestrische Physik, Garching, Germany

**XMM-Newton Observations of NGC 253: Resolving the Emission Components in the Disk and Nuclear Area**

Pietsch, W., Max-Planck-Inst. fuer Extraterrestrische Physik, Germany; Borozdin, K. N., Los Alamos National Lab., USA; Branduardi-Raymont, G., Mullard Space Science Lab., UK; Cappi, M., Consiglio Nazionale delle Ricerche, Italy; Ehle, M., European Space Agency, France; Ferrando, P., Commissariat à l'Énergie Atomique, France; Freyberg, M. J., Max-Planck-Inst. fuer Extraterrestrische Physik, Germany; Kahn, S. M., Columbia Univ., USA; Ponman, T. J., Birmingham Univ., UK; Ptak, A., Carnegie-Mellon Univ., USA; Sep. 30, 2000; 5p; In English

Contract(s)/Grant(s): NAS5-31429; Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

We describe the first XMM-Newton observations of the starburst galaxy NGC 253. As known from previous X-ray observations, NGC 253 shows a mixture of extended (disk and halo) and point-source emission. The high XMM-Newton throughput allows for the first time a detailed investigation of the spatial, spectral and variability properties of these components simultaneously. We detect a bright X-ray transient approx. 70 sec SSW of the nucleus and show the spectrum and light curve of the brightest point source (approx. 30 sec S of the nucleus, most likely a black-hole X-ray binary, BHXRb). The unprecedented combination of RGS and EPIC also sheds new light on the emission of the complex nuclear region, the X-ray plume and the disk diffuse emission. In particular, EPIC images reveal that the limb-brightening of the plume is mostly seen in higher ionization emission lines, while in the lower ionization lines, and below 0.5 keV, the plume is more homogeneously structured, pointing to new interpretations as to the make up of the starburst-driven outflow. Assuming that type IIa supernova remnants (SNRs) are mostly responsible for the E greater than 4 keV emission, the detection with EPIC of the 6.7 keV line allows us to estimate a supernova rate within the nuclear starburst of 0.2 /yr.

Author

*Black Holes (Astronomy); Emission Spectra; Light Emission; Resolution; Supernova Remnants; X Ray Binaries*

**20030007912** Columbia Univ., Dept. of Physics, New York, NY USA

**Complex Resonance Absorption Structure in the X-Ray Spectrum of IRAS 13349+2438**

Sako, M., Columbia Univ., USA; Kahn, S. M., Columbia Univ., USA; Behar, E., Columbia Univ., USA; Kaastra, J. S., Space Research Organization Netherlands, Netherlands; Brinkman, A. C., Space Research Organization Netherlands, Netherlands; Boller, Th., Max-Planck-Inst. fuer Extraterrestrische Physik, Germany; Puchnarewicz, E. M., Mullard Space Science Lab., UK; Starling, R., Mullard Space Science Lab., UK; Liedahl, D. A., Lawrence Livermore National Lab., USA; Clavel, J., European Space Agency, Spain; Oct. 01, 2000; 5p; In English

Contract(s)/Grant(s): NAS5-31429; Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

The luminous infrared-loud quasar IRAS 13349+2438 was observed with the XMM - Newton Observatory as part of the Performance Verification program. The spectrum obtained by the Reflection Grating Spectrometer (RGS) exhibits broad (FWHM - 1400 km/s) absorption lines from highly ionized elements including hydrogen- and helium-like carbon, nitrogen, oxygen, and neon, and several iron L - shell ions (Fe XVII - XX). Also shown in the spectrum is the first astrophysical detection of a broad absorption feature around  $\lambda = 16 - 17 \text{ \AA}$  identified as an unresolved transition array (UTA) of 2p - 3d inner-shell absorption by iron M-shell ions in a much cooler medium; a feature that might be misidentified as an O VII edge when observed with moderate resolution spectrometers. No absorption edges are clearly detected in the spectrum. We demonstrate that the RGS spectrum of IRAS 13349+2438 exhibits absorption lines from two distinct regions, one of which is tentatively associated with the medium that produces the optical/UV reddening.

Author

*Resonance Lines; X Ray Spectra; Stellar Spectra; Line Spectra; Infrared Radiation*

**20030007913** Columbia Univ., Dept. of Physics, New York, NY USA

**High Resolution X-Ray Spectroscopy of zeta Puppis with the XMM-Newton Reflection Grating Spectrometer**

Kahn, S. M., Columbia Univ., USA; Leutenegger, M. A., Columbia Univ., USA; Cottam, J., Columbia Univ., USA; Rauw, G., Institut d'Astrophysique, Belgium; Vreux, J.-M., Institut d'Astrophysique, Belgium; denBoggende, A. J. F., Space Research Organization Netherlands, Netherlands; Mewe, R., Space Research Organization Netherlands, Netherlands; Guedel, M., Paul Scherrer Inst., Switzerland; Sep. 29, 2000; 6p; In English

Contract(s)/Grant(s): NAS5-31429; P4/05; Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; Distribution as joint owner in the copyright; Distribution as joint owner in the copyright

We present the first high resolution X-ray spectrum of the bright O4Ief supergiant star Puppis, obtained with the Reflection Grating Spectrometer on-board XMM-Newton. The spectrum exhibits bright emission lines of hydrogen-like and helium-like ions of nitrogen, oxygen, neon, magnesium, and silicon, as well as neon-like ions of iron. The lines are all significantly resolved, with characteristic velocity widths of order 1000 - 1500 km/s. The nitrogen lines are especially strong, and indicate that the shocked gas in the wind is mixed with CNO-burned material, as has been previously inferred for the atmosphere of this star from ultraviolet spectra. We find that the forbidden to intercombination line ratios within the helium-like triplets are anomalously low for N VI, O VII, and Ne IX. While this is sometimes indicative of high electron density, we show that in this case, it is instead caused by the intense ultraviolet radiation field of the star. We use this interpretation to derive constraints on the location of the X-ray emitting shocks within the wind that agree remarkably well with current theoretical models for this system.

Author

*Emission Spectra; X Ray Spectroscopy; Helium Ions; High Resolution; Hydrogen; Radiation Distribution; Supergiant Stars; Ultraviolet Spectra*

**20030011465** NASA Johnson Space Center, Houston, TX USA

**Clementine Observations of the Zodiacal Light and the Dust Content of the Inner Solar System**

Hahn, Joseph M., Lunar and Planetary Inst., USA; Zook, Herbert A., NASA Johnson Space Center, USA; Cooper, Bonnie, Oceaneering Space Systems, USA; Sunkara, Bhaskar, Lunar and Planetary Inst., USA; Icarus; 2002; ISSN 0019-1035; Volume 158, pp. 360-378; In English; Original contains color illustrations

Contract(s)/Grant(s): NASW-4574

Report No.(s): LPI-Contrib-1117; Copyright; Avail: Issuing Activity

Using the Moon to occult the Sun, the Clementine spacecraft used its navigation cameras to map the inner zodiacal light at optical wavelengths over elongations of 3 approx. less than epsilon approx. less than 30 deg from the Sun. This surface brightness map is then used to infer the spatial distribution of interplanetary dust over heliocentric distances of about 10 solar radii to the orbit of Venus. The averaged ecliptic surface brightness of the zodiacal light falls off as  $Z(\epsilon)$  is a member of epsilon (sup -2.45 +/- 0.05), which suggests that the dust cross-sectional density nominally falls off as  $\sigma(r)$  is a member of r (sup -1.45 +/- 0.05). The interplanetary dust also has an albedo of  $\alpha$  approx. = 0.1 that is uncertain by a factor of approx. 2. Asymmetries of approx. 10% are seen in directions east-west and north-south of the Sun, and these may be due the giant planets' secular gravitational perturbations. We apply a simple model that attributes the zodiacal light as due to three dust populations having distinct inclination distributions, namely, dust from asteroids and Jupiter-family comets (JFCs) having characteristic inclinations of  $i$  approx. 7 deg, dust from Halley-type comets having  $i$  approx. 33 deg, and an isotropic cloud of dust from Oort Cloud comets. The best-fitting scenario indicates that asteroids + JFCs are the source of about 45% of the optical dust cross section seen in the ecliptic at 1 AU but that at least 89% of the dust cross section enclosed by a 1-AU-radius sphere is of a cometary origin. Each

population's radial density variations can also deviate somewhat from the nominal  $\sigma(r)$  is a member of  $r(\sup -1.45)$ . When these results are extrapolated out to the asteroid belt, we find an upper limit on the mass of the light-reflecting asteroidal dust that is equivalent to a 12-km asteroid, and a similar extrapolation of the isotropic dust cloud out to Oort Cloud distances yields a mass equivalent to a 30-km comet, although the latter mass is uncertain by orders of magnitude.

Author

*Zodiacal Light; Solar System; Asteroids; Cloud-to-Cloud Discharges; Interplanetary Dust*

## 90 ASTROPHYSICS

*Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.*

**20030007769** NASA Ames Research Center, Moffett Field, CA USA

### **Hierarchies of Models: Toward Understanding Planetary Nebulae**

Knuth, Kevin H., NASA Ames Research Center, USA; Hajian, Arsen R., Naval Observatory, USA; [2003]; 17p; In English; Maximum Entropy and Bayesian Methods, 3-7 Aug. 2002, Moscow, ID, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Stars like our sun (initial masses between 0.8 to 8 solar masses) end their lives as swollen red giants surrounded by cool extended atmospheres. The nuclear reactions in their cores create carbon, nitrogen and oxygen, which are transported by convection to the outer envelope of the stellar atmosphere. As the star finally collapses to become a white dwarf, this envelope is expelled from the star to form a planetary nebula (PN) rich in organic molecules. The physics, dynamics, and chemistry of these nebulae are poorly understood and have implications not only for our understanding of the stellar life cycle but also for organic astrochemistry and the creation of prebiotic molecules in interstellar space. We are working toward generating three-dimensional models of planetary nebulae (PNe), which include the size, orientation, shape, expansion rate and mass distribution of the nebula. Such a reconstruction of a PN is a challenging problem for several reasons. First, the data consist of images obtained over time from the Hubble Space Telescope (HST) and spectra obtained from Kitt Peak National Observatory (KPNO) and Cerro Tololo Inter-American Observatory (CTIO). These images are of course taken from a single viewpoint in space, which amounts to a very challenging tomographic reconstruction. Second, the fact that we have two disparate and orthogonal data types requires that we utilize a method that allows these data to be used together to obtain a solution. To address these first two challenges we employ Bayesian model estimation using a parameterized physical model that incorporates much prior information about the known physics of the PN. In our previous works we have found that the forward problem of the comprehensive model is extremely time consuming. To address this challenge, we explore the use of a set of hierarchical models, which allow us to estimate increasingly more detailed sets of model parameters. These hierarchical models of increasing complexity are akin to scientific theories of increasing sophistication, with each new model/theory being a refinement of a previous one by either incorporating additional prior information or by introducing a new set of parameters to model an entirely new phenomenon. We apply these models to both a simulated and a real ellipsoidal PN to initially estimate the position, angular size, and orientation of the nebula as a two-dimensional object and use these estimates to later examine its three-dimensional properties. The efficiency/accuracy tradeoffs of the techniques are studied to determine the advantages and disadvantages of employing a set of hierarchical models over a single comprehensive model.

Author

*Astronomical Models; Planetary Nebulae; Stellar Atmospheres; Mathematical Models*

**20030007896** Massachusetts Inst. of Tech., Dept. of Earth and Atmospheric Planetary Sciences, Cambridge, MA USA

### **Water of Hydration on C-class Asteroids: Does Size Matter? Progress Report, 15 Mar. 2002 - 14 Mar. 2003**

Rivkin, Andrew, Massachusetts Inst. of Tech., USA; [2003]; 4p; In English; Original contains color illustrations  
Contract(s)/Grant(s): NAG5-10604; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A progress report on the water content of C-Class asteroids is presented.

CASI

*Asteroids; Hydration; Moisture Content; Mineralogy*

**20030007897** Arizona Univ., Lunar and Planetary Lab., Tucson, AZ USA

### **Near-Infrared Spectrophotometry of Phobos and Deimos**

Rivkin, A. S., Arizona Univ., USA; Brown, R. H., Arizona Univ., USA; Trilling, D. E., Pennsylvania Univ., USA; Bell, J. F., III, Cornell Univ., USA; Plassmann, J. H., Arizona Univ., USA; Icarus; 2002; ISSN 0019-1035; Volume 156, pp. 64-75; In English;

Original contains color illustrations

Contract(s)/Grant(s): NAG5-10328; Copyright; Avail: Issuing Activity

We have observed the leading and trailing hemispheres of Phobos from 1.65 to 3.5 microns and Deimos from 1.65 to 3.12 microns near opposition. We find the trailing hemisphere of Phobos to be brighter than its leading hemisphere by  $0.24 \pm 0.06$  magnitude at 1.65 microns and brighter than Deimos by  $0.98 \pm 0.07$  magnitude at 1.65 microns. We see no difference larger than observational uncertainties in spectral slope between the leading and trailing hemispheres when the spectra are normalized to 1.65 microns. We find no 3-micron absorption feature due to hydrated minerals on either hemisphere to a level of approx. 5-10% on Phobos and approx. 20% on Deimos. When the infrared data are joined to visible and near-IR data obtained by previous workers, our data suggest the leading (Stickney-dominated) side of Phobos is best matched by T-class asteroids. The spectral slope of the trailing side of Phobos and leading side of Deimos are bracketed by the D-class asteroids. The best laboratory spectral matches to these parts of Phobos are mature lunar soils and heated carbonaceous chondrites. The lack of 3-micron absorption features on either side of Phobos argues against the presence of a large interior reservoir of water ice according to current models of Phobos' interior.

Author

*Spectrophotometry; Infrared Astronomy; Phobos; Deimos*

**20030011464** Massachusetts Inst. of Tech., Cambridge, MA USA

**Hydrogen Concentrations on C-class Asteroids from Remote Sensing**

Rivkin, A. S., Massachusetts Inst. of Tech., USA; Davies, J. K., Royal Observatory, UK; Johnson, J. R., Geological Survey, USA; Ellison, S. L., Victoria Univ., Canada; Trilling, D. E., Pennsylvania Univ., USA; Brown, R. H., Arizona Univ., USA; Lebofsky, L. A., Arizona Univ., USA; Dec. 30, 2002; 2p; In English

Contract(s)/Grant(s): NAG5-10604; No Copyright; Avail: Issuing Activity; Abstract Only

We present spectroscopic observations of 16 asteroids from 1.9-3.6 microns, collected from the UK Infrared Telescope (UKIRT) from 1996-2000. Of these 16 asteroids, 11 show some evidence of a 3-micron hydrated mineral absorption feature greater than 2 sigma at 2.9 microns. Using relations first recognized for carbonaceous chondrite powders by Miyamoto and Zolensky (1994) and Sato et al. (1997), we have determined the hydrogen/silicon ratio for these asteroids and calculated their equivalent water contents, assuming all the hydrogen was in water. The asteroids split into two groups, roughly defined as equivalent water contents of greater than approx. 7% (eight asteroids) and less than approx. 3% (the remaining eight asteroids). This latter group includes some asteroids for which there is a small but statistically significant 3-micron band of non-zero depth. The G-class asteroids in the survey have higher water contents, consistent with CM chondrites. This strengthens the connection between CM chondrites and G asteroids that was proposed by Burbine (1998). We find that the 0.7-micron and 3-micron band depths are correlated for the population of target objects.

Author

*Remote Sensing; Hydrogen; Asteroids; Infrared Astronomy; Infrared Spectroscopy*

**20030011466** NASA Ames Research Center, Moffett Field, CA USA

**Differential Cratering of Synchronously Rotating Satellites by Ecliptic Comets**

Zahnle, Kevin, NASA Ames Research Center, USA; Schenk, Paul, Lunar and Planetary Inst., USA; Sobieszczyk, Steven, Wisconsin Univ., USA; Dones, Luke, Southwest Research Inst., USA; Levison, Harold F., Southwest Research Inst., USA; Icarus; 2002; ISSN 0019-1035; Volume 153, pp. 111-129; In English; Copyright; Avail: Issuing Activity

We use Monte Carlo methods to simulate impacts of ecliptic comets on the synchronously rotating satellites of giant planets. We reconfirm the long-standing prediction that the cratering rate should be much higher on the leading hemispheres than on the trailing hemisphere; indeed we find that previously published analytical formulations modestly underestimate the degree of apex-antapex asymmetry to be expected. We then compare our results to new mapping of impact craters on Ganymede, Callisto, and Triton. Ganymede reveals a pronounced apex-antapex asymmetry that is nonetheless much less than predicted. All of Triton's confirmed impact craters are clustered toward the apex of motion, far exceeding the predicted asymmetry. No asymmetry is observed on Callisto. In each case at least one of our basic assumptions must be wrong. Likely candidates include the following: (i) the surfaces of all but the most sparsely cratered satellites are saturated or nearly saturated with impact craters; (ii) these satellites have rotated nonsynchronously over geological time; (iii) most of the craters are made not by heliocentric (Sun-orbiting) comets and asteroids but rather by planetocentric (planet-orbiting) debris of indeterminate origin; or (iv) pathological endogenic resurfacing has created illusions of structure. Callisto's surface is readily classified as nearly saturated. Ganymede's bright terrains, although less heavily cratered than those of Callisto, can also be explained by crater densities approaching saturation on a world where endogenic processes were active. The leading alternative is nonsynchronous rotation, an explanation supported



by the distribution of catenae (crater chains produced by impact of tidally disrupted comets). Triton's craters can be explained by planetocentric debris or by capricious resurfacing, but both hypotheses are inherently improbable.

Author

*Comets; Cratering; Ecliptic; Gas Giant Planets; Jupiter Satellites; Monte Carlo Method*

## 91

### LUNAR AND PLANETARY SCIENCE AND EXPLORATION

*Includes planetology; selenology; meteorites; comets; and manned and unmanned planetary and lunar flights. For spacecraft design or space stations see 18 Spacecraft Design, Testing and Performance.*

**20030007772** National Center for Atmospheric Research, Boulder, CO USA

#### **Introduction to Genetic Algorithms for Numerical Optimization**

Charbonneau, P.; Mar. 2002; 82p

Report No.(s): PB2003-100189; NCAR/TN-450/1A; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Section 1 establishes the distinction between local and global optimization and the meaning of performance measures in the context of global optimization. Section 2 introduces the general idea of a genetic algorithm, as inspired from the biological process of evolution by means of natural selection. Section 3 provides a detailed comparison of the performance of three genetic algorithm-based optimization schemes against iterated hill climbing using the simplex method. Section 4 describes in full detail the use of a genetic algorithm to solve a real data modeling problem, namely the determination of orbital elements of a binary star system from observed radial velocities. The paper closes in Section 5 with reflections on matters of a somewhat more philosophical nature, and includes a list of suggested further readings.

NTIS

*Optimization; Genetic Algorithms; Numerical Analysis*

**20030007843** MRJ Technology Solutions, Inc., Moffett Field, CA USA

#### **Real-Time Lunar Prospector Data Visualization Using Web-Based Java**

Deardorff, D. Glenn, MRJ Technology Solutions, Inc., USA; Green, Bryan D., MRJ Technology Solutions, Inc., USA; [1998]; 10p; In English; 37th Aerospace Sciences Meeting and Exhibit, 11-14 Jan. 1999, Reno, NV, USA

Contract(s)/Grant(s): NAS2-14303; RTOP 519-40-72

Report No.(s): AIAA Paper 99-0691; Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche; Distribution under U.S. Government purpose rights under contract number NAS2-14303; Distribution under U.S. Government purpose rights under contract number NAS2-14303

The Lunar Prospector was co-developed by NASA Ames Research Center and Lockheed Martin, and was launched on January 6th, 1998. Its mission is to search for water ice and various elements in the Moon's surface, map its magnetic and gravity fields, and detect volcanic activity. For the first time, the World Wide Web is being used to graphically display near-real-time data from a planetary exploration mission to the global public. Science data from the craft's instruments, as well as engineering data for the spacecraft subsystems, are continuously displayed in time-varying XY plots. The craft's current location is displayed relative to the whole Moon, and as an off-craft observer would see in the reference frame of the craft, with the lunar terrain scrolling underneath. These features are implemented as Java applets. Analyzed data (element and mass distribution) is presented as 3D lunar maps using VRML and Javascript. During the development phase, implementations of the Java Virtual Machine were just beginning to mature enough to adequately accommodate our target featureset; incomplete and varying implementations were the biggest bottleneck to our ideal of ubiquitous browser access. Bottlenecks notwithstanding, the reaction from the Internet community was overwhelmingly enthusiastic.

Author

*Real Time Operation; Scientific Visualization; Java (Programming Language); World Wide Web; Lunar Prospector*

**20030007903** Lunar and Planetary Inst., Houston, TX USA

#### **Thickness Constraints on the Icy Shells of the Galilean Satellites from a Comparison of Crater Shapes**

Schenk, Paul M., Lunar and Planetary Inst., USA; Nature; May 23, 2002; Volume 417, pp. 419-421; In English; Original contains color illustrations

Contract(s)/Grant(s): NASW-4574; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

A thin outer ice shell on Jupiter's large moon Europa would imply easy exchange between the surface and any organic or biotic material in its putative subsurface ocean. The thickness of the outer ice shell is poorly constrained, however, with

model-dependent estimates ranging from a few kilometers of depths of impact craters on Europa, Ganymede and Callisto that reveal two anomalous transitions in crater shape with diameter. The first transition is probably related to temperature-dependent ductility of the crust at shallow depths (7-8 km on Europa). The second transition is attributed to the influence of subsurface oceans on all three satellites, which constrains Europa's icy shell to be at least 19 km thick. The icy lithospheres of Ganymede and Callisto are equally ice-rich, but Europa's icy shell has a thermal structure about 0.25-0.5 times the thickness of Ganymede's or Callisto's shells, depending on epoch. The appearances of the craters on Europa are inconsistent with thin-ice-shell models and indicate that exchange of oceanic and surface material could be difficult.

Author

*Craters; Galilean Satellites; Ice; Thickness; Planetary Surfaces*

**20030007904** Lunar and Planetary Inst., Houston, TX USA

**Integration of Lunar Polar Remote-Sensing Data Sets: Evidence for Ice at the Lunar South Pole**

Nozette, Stewart, Naval Research Lab., USA; Spudis, Paul D., Lunar and Planetary Inst., USA; Robinson, Mark S., Northwestern Univ., USA; Bussey, D. B. J., Northwestern Univ., USA; Lichtenberg, Chris, Naval Research Lab., USA; Bonner, Robert, Protasis, Inc., USA; Journal of Geophysical Research; October 2001; ISSN 0148-0227; Volume 106, No. E10, pp. 23253-23266; In English; Original contains color illustrations

Contract(s)/Grant(s): NASA Order T-250-W

Report No.(s): Paper-2000JE001417; LPI-Contrib-99-1059; Copyright; Avail: Issuing Activity

In order to investigate the feasibility of ice deposits at the lunar south pole, we have integrated all relevant lunar polar data sets. These include illumination data, Arecibo ground-based monostatic radar data, newly processed Clementine bistatic radar data, and Lunar Prospector neutron spectrometer measurements. The possibility that the lunar poles harbor ice deposits has important implications not only as a natural resource for future human lunar activity but also as a record of inner solar system volatiles (e.g., comets and asteroids) over the past billion years or more. We find that the epithermal neutron flux anomalies, measured by Lunar Prospector, are coincident with permanently shadowed regions at the lunar south pole, particularly those associated with Shackleton crater. Furthermore, these areas also correlate with the beta=0 circular polarization ratio (CPR) enhancements revealed by new processing of Clementine bistatic radar echoes, which in turn are colocated with areas of anomalous high CPR observed by Arecibo Observatory on the lower, Sun-shadowed wall of Shackleton crater. Estimates of the extent of high CPR from Arecibo Observatory and Clementine bistatic radar data independently suggest that approximately 10 square kilometers of ice may be present on the inner Earth-facing wall of Shackleton crater. None of the experiments that obtained the data presented here were ideally suited for definitively identifying ice in lunar polar regions. By assessing the relative merits of all available data, we find that it is plausible that ice does occur in cold traps at the lunar south pole and that future missions with instruments specifically designed to investigate these anomalies are worthy.

Author

*Ice; Polar Regions; Remote Sensing; Lunar Surface; Anomalies; Radar Data*

**20030009905** Provemy Research, Inc., Laytonsville, MD USA

**Statistical Distribution of Inflation on Lava Flows: Analysis of Flow Surfaces on Earth and Mars**

Glazel, L. S., Provemy Research, Inc., USA; Anderson, S. W., Provemy Research, Inc., USA; Stofan, E. R., Provemy Research, Inc., USA; Baloga, S., Provemy Research, Inc., USA; [2003]; 15p; In English

Contract(s)/Grant(s): NAG5-7251; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The surface morphology of a lava flow results from processes that take place during the emplacement of the flow. Certain types of features, such as tumuli, lava rises and lava rise pits, are indicators of flow inflation or endogenous growth of a lava flow. Tumuli in particular have been identified as possible indicators of tube location, indicating that their distribution on the surface of a lava flow is a junction of the internal pathways of lava present during flow emplacement. However, the distribution of tumuli on lava flows has not been examined in a statistically thorough manner. In order to more rigorously examine the distribution of tumuli on a lava flow, we examined a discrete flow lobe with numerous lava rises and tumuli on the 1969 - 1974 Mauna Ulu flow at Kilauea, Hawaii. The lobe is located in the distal portion of the flow below Holei Pali, which is characterized by hummocky pahoehoe flows emplaced from tubes. We chose this flow due to its discrete nature allowing complete mapping of surface morphologies, well-defined boundaries, well-constrained emplacement parameters, and known flow thicknesses. In addition, tube locations for this Mauna Ulu flow were mapped by Holcomb (1976) during flow emplacement. We also examine the distribution of tumuli on the distal portion of the hummocky Thrafniskjoldur flow field provided by Rossi and Gudmundsson (1996). Analysis of the Mauna Ulu and Thrafniskjoldur flow lobes and the availability of high-resolution MOC images motivated us to look for possible tumuli-dominated flow lobes on the surface of Mars. We identified a MOC image of a lava flow south of Elysium Mons with features morphologically similar to tumuli. The flow is characterized by raised elliptical to circular mounds,

some with axial cracks, that are similar in size to the tumuli measured on Earth. One potential avenue of determining whether they are tumuli is to look at the spatial distribution to see if any patterns similar to those of tumuli-dominated terrestrial flows can be identified. Since tumuli form by the injection of lava beneath a crust, the distribution of tumuli on a flow should represent the distribution of thermally preferred pathways beneath the surface of the crust. That distribution of thermally preferred pathways may be a function of the evolution of a basaltic lava flow. As a longer-lived flow evolves, initially broad thermally preferred pathways would evolve to narrower, more well-defined tube-like pathways. The final flow morphology clearly preserves the growth of the flow over time, with inflation features indicating pathways that were not necessarily contemporaneously active. Here, we test using statistical analysis whether this final flow morphology produces distinct distributions that can be used to readily determine the distribution of thermally preferred pathways beneath the surface of the crust.

Author

*Statistical Distributions; Lava; Flow Distribution; Morphology; Earth Surface; Mars Surface*

**20030010291** Lunar and Planetary Inst., Houston, TX USA

**Oceans, Ice Shells, and Life on Europa**

Schenk, Paul, Lunar and Planetary Inst., USA; Noveber 2002; 6p; In English

Contract(s)/Grant(s): NASW-4574; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The four large satellites of Jupiter are famous for their planet-like diversity and complexity, but none more so than ice-covered Europa. Since the provocative Voyager images of Europa in 1979, evidence has been mounting that a vast liquid water ocean may lurk beneath the moon's icy surface. Europa has since been the target of increasing and sometimes reckless speculation regarding the possibility that giant squid and other creatures may be swimming its purported cold, dark ocean. No wonder Europa tops everyone's list for future exploration in the outer solar system (after the very first reconnaissance of Pluto and the Kuiper belt, of course). Europa may be the smallest of the Galilean moons (so-called because they were discovered by Galileo Galilei in the early 17th century) but more than makes up for its diminutive size with a crazed, alien landscape. The surface is covered with ridges hundreds of meters high, domes tens of kilometers across, and large areas of broken and disrupted crust called chaos. Some of the geologic features seen on Europa resemble ice rafts floating in polar seas here on Earth-reinforcing the idea that an ice shell is floating over an ocean on this Moon-size satellite. However, such features do not prove that an ocean exists or ever did. Warm ice is unusually soft and will flow under its own weight. If the ice shell is thick enough, the warm bottom of the shell will flow, as do terrestrial glaciers. This could produce all the observed surface features on Europa through a variety of processes, the most important of which is convection. (Convection is the vertical overturn of a layer due to heating or density differences-think of porridge or sauce boiling on the stove.) Rising blobs from the base of the crust would then create the oval domes dotting Europa's surface. The strongest evidence for a hidden ocean beneath Europa's surface comes from the Galileo spacecraft's onboard magnetometer, which detected fluctuations in Jupiter's magnetic field consistent with a conductor inside Europa. The most likely conductor: a somewhat salty ocean.

Author

*Ocean Surface; Ice; Gas Giant Planets; Jupiter Satellites; Planetary Magnetic Fields; Life Sciences*

**20030010369** Lunar and Planetary Inst., Houston, TX USA

**Fractal Analysis of Drainage Basins on Mars**

Stepinski, T. F., Lunar and Planetary Inst., USA; Marinova, M. M., Massachusetts Inst. of Tech., USA; McGovern, P. J., Lunar and Planetary Inst., USA; Clifford, S. M., Lunar and Planetary Inst., USA; Geophysical Research Letters; 2002; ISSN 0094-8276; Volume 29, No. 8, pp. 1-4; In English; Original contains color illustrations

Contract(s)/Grant(s): NASW-4574

Report No.(s): LPI-Contrib-1112; Copyright; Avail: Issuing Activity

We used statistical properties of drainage networks on Mars as a measure of martian landscape morphology and an indicator of landscape evolution processes. We utilize the Mars Orbiter Laser Altimeter (MOLA) data to construct digital elevation maps (DEMs) of several, mostly ancient, martian terrains. Drainage basins and channel networks are computationally extracted from DEMs and their structures are analyzed and compared to drainage networks extracted from terrestrial and lunar DEMs. We show that martian networks are self-affine statistical fractals with planar properties similar to terrestrial networks, but vertical properties similar to lunar networks. The uniformity of martian drainage density is between those for terrestrial and lunar landscapes. Our results are consistent with the roughening of ancient martian terrains by combination of rainfall-fed erosion and impacts, although roughening by other fluvial processes cannot be excluded. The notion of sustained rainfall in recent Mars history is inconsistent with our findings.

Author

*Digital Data; Drainage; Erosion; Mars Surface; Planetary Geology*

**20030011271** Catholic Univ. of America, Dept. of Chemistry, Washington, DC USA

**Studies of Elementary Reactions of Chemical Importance in the Atmospheres of Planets *Progress Report, 1 May 2001 - 30 Apr. 2002***

Nesbitt, Fred L., Catholic Univ. of America, USA; May 31, 2002; 7p; In English

Contract(s)/Grant(s): NCC5-452; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A progress report on the reaction kinetics of methyl radicals in the atmospheres of Neptune and Saturn are presented.

CASI

*Planetary Atmospheres; Reaction Kinetics; Radicals; Methyl Compounds*

**20030011283** NASA Langley Research Center, Hampton, VA USA

**Exobiological Exploration of Europa (E3) Europa Lander**

Stillwagen, F. H., NASA Langley Research Center, USA; Manvi, Ramachandra, Jet Propulsion Lab., California Inst. of Tech., USA; Seywald, Hans, Analytical Mechanics Associates, Inc., USA; Park, Sang-Young, Swales Aerospace, USA; Kolacinski, Rick, Swales Aerospace, USA; [2002]; 20p; In English; 53rd International Astronautical Congress, 10-19 Oct. 2002, Houston, TX, Houston, TX, USA, USA; Sponsored by International Astronautical Federation, Unknown; Original contains color illustrations

Report No.(s): IAF-02-Q.2.04; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The search for life outside Earth's protected atmosphere is a compelling testament to the quest by mankind to determine if "we" are alone in the universe. The phenomenal success of the NASA Galileo spacecraft has indicated that the moons of Jupiter, and most notably Europa, may indeed contain subsurface liquid under an icy surface. This speculation of a salty liquid subsurface fuels expert opinions that biological products may exist. The Revolutionary Aerospace Systems Concepts (RASC) effort at Langley Research Center, initiated by NASA Headquarters, pushes NASA and the Aerospace/Science community to target advanced evolutionary technology usage to provide a Europa Lander concept targeted for completion within the next 50 years. The study effort indicates the use of certain advanced technologies to achieve a subsurface penetrator and liquid explorer in the approximately 2040 timeframe.

Author

*Europa; Exobiology; Galileo Spacecraft; Planetary Surfaces; Exploration; Planetary Mapping*

**20030011363** Lunar and Planetary Inst., Houston, TX USA

**Workshop on Spectroscopy of the Martian Surface: What Next?**

Kirkland, L., Editor, Lunar and Planetary Inst., USA; Salisbury, J., Editor, Lunar and Planetary Inst., USA; Mustard, J., Editor, Lunar and Planetary Inst., USA; Clark, R., Editor, Lunar and Planetary Inst., USA; Lucey, P., Editor, Lunar and Planetary Inst., USA; Murchie, S., Editor, Lunar and Planetary Inst., USA; 2002; 38p; In English, 10-11 Jun. 1999, Houston, TX, USA; Sponsored by Lunar and Planetary Inst., USA; Also announced as 20030011364 through 20030011375

Contract(s)/Grant(s): NASW-4574

Report No.(s): LPI-Contrib-1149; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Members of the Mars infrared spectral community desired to assess what spectral instrument will best serve the Mars program and spectral community after the successful flight of currently planned instruments. It was felt this issue needed to be addressed, given the shift of the NASA Mars program toward a search for regions conducive to the preservation of biomarkers, and the desire for sample return. To this end, leaders of the planetary community with expertise in spectroscopy and remote mineral identification met to discuss the state of understanding of Mars surface composition, and to assess what critical gaps may exist: 1) after the successful completion of planned measurements of Mars; and 2) in research programs to support investigations of the current and planned data sets. Participants also discussed the proposed Mars airplane. This report summarizes our consensus.

Author

*Mars Surface; Spectroscopy; Infrared Spectra; Mars Exploration; Planetary Geology*

**20030011364** Space Science Inst., Boulder, CO USA

**Sub-Pixel Detection and Mapping of Spectrally Unique Materials on Mars Using ISM Data**

Farrand, William H., Space Science Inst., USA; Workshop on Spectroscopy of the Martian Surface: What Next?; 2002; 2p; In English; Also announced as 20030011363; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

One of the primary goals in the exploration of Mars is the location of geologic deposits formed by, or associated with, liquid water. These types of deposits would include hot spring formed materials (silica and calcic sinters), cold spring formed materials (ferricretes, tufas, travertines), evaporites, carbonates, and mineral deposits formed by hydrothermal activity (containing sulfides,



and sulfide alteration products). Many of these deposits, in particular spring-formed deposits, are spatially restricted in area. In fact, the ground instantaneous field of view (GIFOV) of current and planned Mars orbital multi- and hyperspectral sensors is greater than many of these types of deposits. Hence, in order to find these types of deposits using existing and planned sensors, sub-pixel detection techniques will be necessary. A number of techniques that can detect materials at spatial coverages of less than 10% of a pixel have been developed for terrestrial airborne multi- and hyperspectral sensors. These techniques can be applied against Mars multi- or hyperspectral data sets to very good effect. Anomalous pixels mapped with sub-pixel detection methods can be located on higher resolution panchromatic (Viking Orbiter or MGC MOC) imagery. In this paper the applicability of one of these techniques, Foreground/Background Analysis (FBA) will be tested against ISM data from the Phobos 2 mission.

Author

*Detection; Pixels; Mars Surface; Planetary Geology; Mars Exploration; Planetary Mapping*

**20030011365** Arizona State Univ., AZ USA

**Environmental and Mineralogical Controls on Fossilization: Key Elements in a Strategy for Mars Exopaleontology**

Farmer, J. D., Arizona State Univ., USA; Workshop on Spectroscopy of the Martian Surface: What Next?; 2002; 3p; In English; Also announced as 20030011363; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Observations drawn from terrestrial paleontology comprise crucial elements in the present strategy to explore for a fossil record on Mars. In the most detailed sense, the strategy has yet to be applied. At the bottom line, successful application to the problem of site selection will involve more than just identifying sites where water was present. There are many sites on Earth where water is abundant but fossils rare or absent. In selecting landing sites on Mars we must be able to take the strategy to the next level of application by asking crucial questions about the early diagenetic mineralization, and the other factors of the sedimentary systems that are required for microbial fossilization. From an exploration standpoint, the first step in the process is to identify and locate the right kinds of deposits. Mineralogy provides the most reliable information for properly assessing the potential for capturing and preserving of a fossil record. In meeting this important requirement, high spatial resolution mineralogical mapping should be given the highest priority in future missions.

Derived from text

*Fossils; Mineralogy; Paleontology; Geochemistry; Mars Surface; Mars Exploration*

**20030011366** Centre National de la Recherche Scientifique, Inst. d'Astrophysique Spatiale, Orsay, France

**What ISM Told Us About Mars**

Erard, S., Centre National de la Recherche Scientifique, France; Workshop on Spectroscopy of the Martian Surface: What Next?; 2002; 2p; In English; Also announced as 20030011363; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

ISM was the imaging spectrometer of the Phobos-2 mission, the first space-borne instrument of this type to return scientific data from the planets. The instrument was developed by IAS and DESPA in France, with support from CNES. Between January and March 1989, it returned approximately 80Mbit of data consisting mainly in 9 medium resolution (25km) and 2 high-resolution (7km) image cubes of Mars. All observations were performed in the equatorial regions, and span the 0.73-3.15 micrometer domain in 128 spectral channels. ISM also acquired one image cube of Phobos at 700m resolution, and various limb observations of Mars. Although the spectral resolution of ISM is comparable to that of previous ground-based observations, its angular resolution (12'x12') and signal-to-noise ratio (up to 1500) are much better than those of any other spectral measurement on Mars, and remain unchallenged in this spectral range. The public release of the PDS-formatted data set is expected in 1999 (CNES Planetary data base). A preliminary version of the archive, including calibrated and derived data, has been widely distributed for several years directly by IAS.

Derived from text

*Mars Surface; Imaging Spectrometers; Data Acquisition; Spacecraft Instruments; Spectral Resolution; Onboard Equipment*

**20030011367** Centre National de la Recherche Scientifique, Inst. d'Astrophysique Spatiale, Orsay, France

**OMEGA: The Imaging Spectrometer on Board Mars-Express**

Erard, Stephane, Centre National de la Recherche Scientifique, France; Bibring, Jean-Pierre, Centre National de la Recherche Scientifique, France; Workshop on Spectroscopy of the Martian Surface: What Next?; 2002; 2p; In English; Also announced as 20030011363; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

OMEGA is a second generation instrument developed after ISM/Phobos-2. OMEGA was originally developed for the Mars-96 mission by IAS and DESPA in France, IFSI in Italy and IKI in Moscow. OMEGA spare unit has been selected to fly on board the Mars Express ESA mission, planned to launch in 2003. The main differences with ISM performances include extended spectral range at both shorter and longer wavelengths (0.5-5.2 micrometers), and increased angular and spectral resolutions. The instrument is made up of two co-aligned channels (visible and NIR), each using a dedicated telescope and foreoptics.

Derived from text

*European Space Agency; Imaging Spectrometers; Mars Surface; Spaceborne Telescopes; Onboard Data Processing*

**20030011368** Hanel (R. A.), Ann Arbor, MI USA

**1971 Mariner Mars Interferometer Spectrometer (IRIS)**

Hanel, R. A., Hanel (R. A.), USA; Workshop on Spectroscopy of the Martian Surface: What Next?; 2002; 2p; In English; Also announced as 20030011363; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

A south polar-spectrum showed a mixture of dark and bright areas. Ignoring the gaseous CO<sub>2</sub> and water bands as well as the dust signature, one could fit the spectrum well with a superposition of two blackbodies, one with a temperature of about 140 K and a second one with 235 K. The relative strength of the blackbody spectra was in agreement with the areas of bright and dark surfaces observed simultaneously by the Imaging System for the IRIS field of view, suggesting the colder surface to be CO<sub>2</sub> ice and the warmer exposed soil after the ice had evaporated. This was clear evidence that the south-polar cap was CO<sub>2</sub> and not water ice. Spectra of the north-polar cap led to the same conclusion. IRIS also identified the so called W-cloud to be water ice. Vertical profiles of atmospheric temperatures lead to east-west profiles of wind speed, indicating a strong circumpolar jet in the southern hemisphere. The general trade-off between spectral and spatial resolution and Signal-to-Noise ratio will be discussed too.

Derived from text

*Imaging Techniques; Interferometers; Mariner Spacecraft; Spectrometers; Polar Regions; Mars (Planet)*

**20030011370** Aerospace Corp., El Segundo, CA USA

**1969 Mariner Mars Infrared Spectrometer: Lessons for Future Exploration**

Herr, K. C., Aerospace Corp., USA; Kirkland, L. E., Lunar and Planetary Inst., USA; Workshop on Spectroscopy of the Martian Surface: What Next?; 2002; 2p; In English; Also announced as 20030011363; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Spectra returned by the 1969 Mariner Mars Infrared Spectrometer (IRS, 1.8 - 14.2 micrometers) have been used in a range of studies of the surface composition of Mars. IRS measured a wide spectral range with good spectral resolution and excellent signal to noise ratio (SNR). Spacecraft spectrometers that have returned spectra of Mars are listed. IRS results, as well as a comparison of IRS, the 1971 IRIS, 1989 ISM, and 1997 TES spectra show that an unambiguous examination of the surface mineralogy of Mars requires: (1) high spectral resolution (approximately 2-5 cm(exp -1) in the thermal region, and approximately 10-20 cm(exp -2 in NIR); (2) high SNR (greater than 600); and (3) continuous spectra measured of the VIS-NIR, overtone, and fundamental regions. Radiometer measurements, such as those provided by Viking IRTM and the proposed 2001 THEMIS, can be used to map spectral type regions. However, fully utilizing a radiometer data set will require complementary high quality spectra for an unambiguous examination of the minerals present.

Derived from text

*Infrared Spectrometers; Mariner Spacecraft; Mars Surface; Mars Exploration; Planetary Geology; Iris Satellites; Mineralogy*

**20030011371** Aerospace Corp., Space and Environment Technology Center, El Segundo, CA USA

**The SEBASS Hyperspectral Imaging Spectrograph: Instrument Description and Sample Thermal Images Obtained Near Flagstaff, Arizona and Mesquite, Nevada**

Keim, Eric R., Aerospace Corp., USA; Workshop on Spectroscopy of the Martian Surface: What Next?; 2002; 1p; In English; Also announced as 20030011363; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The Aerospace Corporation's Spatially Enhanced Broadband Array Spectrograph System (SEBASS) hyperspectral imaging spectrograph uses two 128 x 128 focal-plane arrays to record simultaneous Long-Wave Infrared (LWIR) and Medium-Wave Infrared (MWIR) images (7.8 to 13.5 and 3.0 to 5.5 micrometers). The resulting thermal images can be used for characterization and identification of surface geological features. A brief description of the instrument and its operation on a DeHavilland Twin Otter aircraft will be given, followed by the presentation of preliminary results from data collections over Flagstaff, Arizona and Mesquite, Nevada.

Author

*Imaging Techniques; Spectrographs; Spacecraft Instruments; Thermal Emission; Broadband*

## 92 SOLAR PHYSICS

*Includes solar activity, solar flares, solar radiation and sunspots. For related information see 93 Space Radiation.*

**20030011270** Massachusetts Inst. of Tech., Center for Space Research, Cambridge, MA USA

**Intercalibration and Cross-Correlation of Ace and Wind Solar Wind Data *Final Report, 1 Oct. 1998 - 30 Sep. 2002***

[2003]; 21p; In English; Original contains color illustrations

Contract(s)/Grant(s): NAG5-7794

Report No.(s): MIT-OSP-6792900; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report covers activities funded from October 1, 1998 through September 30, 2002. Two yearly status reports have been filed on this grant, and they are included as Appendix 1. The purpose of this grant was to compare ACE and Wind solar wind parameters when the two spacecraft were near to one another and then to use the intercalibrated parameters to carry out scientific investigations. In September, 2001 a request for a one-year, no-cost extension until September 30, 2002 was submitted and approved. The statement of work for that extension included adjustment of ACE densities below wind speeds of 350 km/s, a study of shock normal orientations using travel time delays between the two spacecraft, comparison of density jumps at shocks, and a study of temperature anisotropies and double streaming to see if such features evolved between the spacecraft.

Derived from text

*Cross Correlation; Intercalibration; Solar Wind; Wind/Ggs Spacecraft; Advanced Composition Explorer; Data Acquisition*

**20030011369** Hawaii Univ., Hawaii Inst. of Geophysics and Planetology, Honolulu, HI USA

**Remote Sensing Spectroscopy for the Polar Regions of Mars**

Hansen, G. B., Hawaii Univ., USA; Workshop on Spectroscopy of the Martian Surface: What Next?; 2002; 2p; In English; Also announced as 20030011363; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Orbital spectral measurements of the volatile (CO<sub>2</sub>, H<sub>2</sub>O) polar caps of Mars can potentially answer many questions about the current climate, and the inventory and transport of volatiles and dust. These, in turn, can address questions related to past and future climates and the ultimate reservoir sizes for volatiles. The observations in the polar night require thermal infrared or active instruments (that provide their own illumination). However, the most diagnostic bands for both CO<sub>2</sub> and H<sub>2</sub>O occur in the solar reflected Wavelengths 4 pm and are easiest to measure after spring sunrise.

Derived from text

*Mars Surface; Polar Caps; Polar Regions; Remote Sensing; Spectroscopy*

**20030011400** Institut Royal Meteorologique de Belgique, Brussels, Belgium

**Measuring Solar Radiation Incident on Earth: Solar Constant-3 (SOLCON-3)**

Crommelynck, Dominique, Institut Royal Meteorologique de Belgique, Belgium; Joukoff, Alexandre, Institut Royal Meteorologique de Belgique, Belgium; Dewitte, Steven, Institut Royal Meteorologique de Belgique, Belgium; STS 107 Shuttle Press Kit: Providing 24/7 Space Science Research; Dec. 16, 2002, pp. 67-68; In English; Also announced as 20030011376; Original contains color illustrations

Report No.(s): NASA/NP-2002-5-288-HQ; NAS 1.83:5-288-HQ; No Copyright; Avail: CASI; A01, Hardcopy; A02, Microfiche

Life on Earth is possible because the climate conditions on Earth are relatively mild. One element of the climate on Earth, the temperature, is determined by the heat exchanges between the Earth and its surroundings, outer space. The heat exchanges take place in the form of electromagnetic radiation. The Earth gains energy because it absorbs solar radiation, and it loses energy because it emits thermal infrared radiation to cold space. The heat exchanges are in balance: the heat gained by the Earth through solar radiation equals the heat lost through thermal radiation. When the balance is perturbed, a temperature change and hence a climate change of the Earth will occur. One possible perturbation of the balance is the CO<sub>2</sub> greenhouse effect: when the amount of CO<sub>2</sub> in the atmosphere increases, this will reduce the loss of thermal infrared radiation to cold space. Earth will gain more heat and hence the temperature will rise. Another perturbation of the balance can occur through variation of the amount of energy emitted by the sun. When the sun emits more energy, this will directly cause a rise of temperature on Earth. For a long time scientists believed that the energy emitted by the sun was constant. The 'solar constant' is defined as the amount of solar energy received per unit surface at a distance of one astronomical unit (the average distance of Earth's orbit) from the sun. Accurate measurements of the variations of the solar constant have been made since 1978. From these we know that the solar constant varies approximately with the 11-year solar cycle observed in other solar phenomena, such as the occurrence of sunspots, dark spots that are sometimes visible on the solar surface. When a sunspot occurs on the sun, since the spot is dark, the radiation (light) emitted by the sun drops instantaneously. Oddly, periods of high solar activity, when a lot of sunspot numbers increase, correspond to

periods when the average solar constant is high. This indicates that the background on which the sunspots occur becomes brighter during high solar activity.

Author

*Solar Radiation; Incident Radiation; Radiation Measurement; Spaceborne Experiments*

**20030011518** NASA Langley Research Center, Hampton, VA USA

**Comparison of ScaRaB, GOES 8, Aircraft, and Surface Observations of the Absorption of Solar Radiation by Clouds**

Pope, Shelly K., California Univ., USA; Valero, Francisco P. J., California Univ., USA; Collins, William D., National Center for Atmospheric Research, USA; Minnis, Patrick, NASA Langley Research Center, USA; Journal of Geophysical Research; Jun. 05, 2002; ISSN 0148-0227; Volume 107, No. D11, pp. 1-8; In English

Contract(s)/Grant(s): NAGW-4777; DE-FG03-95ER-69183; DE-AI02-97ER-62341; LG-9841; Copyright; Avail: Issuing Activity

Data obtained by the Scanner for Radiation Budget (ScaRaB) instrument on the Meteor 3 satellite have been analyzed and compared to satellite (GOES 8), aircraft (Radiation Measurement System, RAMS), and surface (Baseline Solar Radiation Network (BSRN), Solar and Infrared Observations System (SIROS), and RAMS) measurements of irradiance obtained during the Atmospheric Radiation Measurements Enhanced Shortwave Experiment (ARESE). It is found that the ScaRaB data covering the period from March 1994 to February 1995 (the instrument's operational lifetime) indicate excess absorption of solar radiation by the cloudy atmosphere in agreement with previous aircraft, surface, and GOES 8 results. The full ScaRaB data set combined with BSRN and SIROS surface observations gives an average all-sky absorptance of 0.28. The GOES 8 data set combined with RAMS surface observations gives an average all-sky absorptance of 0.26. The aircraft data set (RAMS) gives a mean all-sky absorptance of 0.24 (for the column between 0.5 and 13 km).

Author

*Solar Radiation; Radiation Absorption; Cloud Cover; Cloud Physics; Data Processing; Scattering; Atmospheric Physics*

**20030011791** Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

**Insights into Corona Formation Through Statistical Analyses**

Glaze, L. S., Proxemy Research, Inc., USA; Stofan, E. R., Proxemy Research, Inc., USA; Smrekar, S. E., Jet Propulsion Lab., California Inst. of Tech., USA; Baloga, S. M., Proxemy Research, Inc., USA; Journal of Geophysical Research; 2002; ISSN 0148-0227; Volume 107, No. E12, pp. 1-12; In English

Contract(s)/Grant(s): NASW-00013; NAG5-10530; RTOP 344-30-43-03; Copyright; Avail: Issuing Activity

Statistical analysis of an expanded database of coronae on Venus indicates that the populations of Type 1 (with fracture annuli) and 2 (without fracture annuli) corona diameters are statistically indistinguishable, and therefore we have no basis for assuming different formation mechanisms. Analysis of the topography and diameters of coronae shows that coronae that are depressions, rimmed depressions, and domes tend to be significantly smaller than those that are plateaus, rimmed plateaus, or domes with surrounding rims. This is consistent with the model of Smrekar and Stofan and inconsistent with predictions of the spreading drop model of Koch and Munga. The diameter range for domes, the initial stage of corona formation, provides a broad constraint on the buoyancy of corona-forming plumes. Coronae are only slightly more likely to be topographically raised than depressions, with Type 1 coronae most frequently occurring as rimmed depressions and Type 2 coronae most frequently occurring with flat interiors and raised rims. Most Type 1 coronae are located along chasmata systems or fracture belts, while Type 2 coronae are found predominantly as isolated features in the plains. Coronae at hot spot rises tend to be significantly larger than coronae in other settings, consistent with a hotter upper mantle at hot spot rises and their active state.

Author

*Statistical Analysis; Buoyancy; Coronae; Planetary Geology; Plateaus*

**99**

**GENERAL**

*Includes aeronautical, astronautical, and space science related histories, biographies, and pertinent reports too broad for categorization; histories or broad overviews of NASA programs such as Apollo, Gemini, and Mercury spacecraft, Earth Resources Technology Satellite (ERTS), and Skylab; NASA appropriations hearings.*

**20030011275** NASA, Washington, DC USA

**Spinoff 2002**

2002; 157p; In English; Original contains color illustrations



Report No.(s): NASA/NP-2002-09-290-HQ; NAS 1.83:09-290-HQ; ISBN 0-16-067542-1; No Copyright; Avail: National Technology Transfer Center (NTTC), Wheeling, WV

Since its inception 40 years ago, NASA's Technology Transfer Program has led the way for our nation to benefit from cutting-edge aerospace technologies. In addition to contributing to U.S. economic growth, these technologies are improving the quality of life on Earth while finding new ways to protect and preserve it. NASA's research and development efforts have advanced areas in medicine, communications, manufacturing, computer technology, and homeland security. These breakthroughs, translated into commercial products, are enhancing the lives of Americans everywhere. When a congressional mandate led NASA to develop the Scientific and Technical Information (STI) Program, the Agency began a wide dissemination of its research and development results. In doing so, NASA recognized that many of its technologies were transferable to industry for the development of commercial products. As a result, the Technology Utilization Program was born in 1962. The successful program went through several changes over the years, as its philosophy, mission, and goals adapted into the Technology Transfer Program we know today. The program strives to make the latest technologies available to industry as soon as they are developed. Each year, NASA's Spinoff publication showcases new products and services resulting from commercial partnerships between NASA and private industry. In the 2002 issue, the NASA field centers reflect upon the growth that has made these innovations available to the public. The Research and Development section examines past achievements, current successes, and future goals for each of the ten NASA centers. The Commercial Benefits section proudly highlights 51 new spinoff products, including a heart pump for patients needing a heart transplant, as well as an air purifier that destroys anthrax spores. The Technology Transfer and Outreach section describes the outreach achievements and educational successes made possible through the NASA Commercial Technology Network. Each section of Spinoff 2002 provides compelling evidence of the Technology Transfer Program's success and value. With commercial products and successes spanning from work on the Apollo missions to the International Space Station, the 40th anniversary of the Technology Transfer Program invites us to celebrate our history while planning the future.

Derived from text

*NASA Programs; Technology Utilization; Aerospace Technology Transfer; Aerospace Sciences; Research and Development*

**20030011417** NASA Goddard Space Flight Center, Greenbelt, MD USA

**Fast Reaction Experiments Enabling Science, Technology, Applications and Research (FREESTAR)**

STS 107 Shuttle Press Kit: Providing 24/7 Space Science Research; Dec. 16, 2002, pp. 104-114; In English; Also announced as 20030011376; No Copyright; Avail: CASI; A03, Hardcopy; A02, Microfiche

Goddard Space Flight Center (GSFC) Wallops Flight Facility (WFF) manages NASA's Shuttle Small Payloads Project (SSPP). The SSPP designs, develops, tests, integrates and flies a group of small payload carrier systems for the space shuttle. These carriers - the Hitchhiker, Getaway Specials (GAS), and Space Experiment Module (SEM) - support payloads supplied by NASA, other U.S. government agencies, universities, high schools, domestic commercial customers, and foreign nationals and governments. These carriers can support payloads that range in size between 50 lbs. (23 kg) and 4,000 lbs. (2,270 kg).

Author

*Space Shuttle Payloads; Spaceborne Experiments; Technology Utilization; Aerospace Technology Transfer; Remote Sensing; Ultraviolet Radiation; Microgravity*

**20030011420** NASA, Washington, DC USA

**Detailed Test Objectives (DTOs) and Detailed Supplementary Objectives (DSOs)**

STS 107 Shuttle Press Kit: Providing 24/7 Space Science Research; Dec. 16, 2002, pp. 124; In English; Also announced as 20030011376; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The purpose of this experiment is to demonstrate the performance and operations of the GPS during orbiter ascent, entry and landing phases utilizing a modified military GPS receiver processor and the existing orbiter GPS antennas. The purpose of this experiment is to demonstrate the capability to perform a manually controlled landing in the presence of a crosswind. Changes in gastrointestinal function and physiology as a result of spaceflight affect drug absorption and the bioavailability of oral medications, which can compromise therapeutic effectiveness. This DSO will lead to the design and development of effective pharmacological countermeasures and therapeutic adjustments for spaceflight. A previous observation suggested that discordant sensory stimuli caused by an unusual motion environment disrupted spatial orientation and balance control in a returning crewmember by triggering a state change in central vestibular processing. The findings of the current investigation are expected to demonstrate the degree to which challenging motion environments may affect post-flight (re)adaptation to gravity.

Author

*Aerospace Medicine; Aerospace Technology Transfer; Technology Utilization; Spaceborne Experiments; Global Positioning System; Space Shuttle Payloads; Drugs*

# Subject Term Index

## Numbers

2001 MARS ODYSSEY, 26

## A

ABLATION, 79  
ABORTED MISSIONS, 22  
ABSORPTION, 40, 43  
ABSORPTION SPECTRA, 40, 43, 60, 152, 156  
ABSORPTION SPECTROSCOPY, 40, 43  
ABSTRACTS, 47, 139, 152, 165  
ACCELERATION MEASUREMENT, 60  
ACCESS CONTROL, 146  
ACCIDENT PREVENTION, 9  
ACCRETION DISKS, 168  
ACOUSTIC EMISSION, 104  
ACOUSTIC IMPEDANCE, 2  
ACOUSTIC RESONANCE, 111  
ACOUSTIC VELOCITY, 154  
ACTIVATION, 110  
ACTIVE CONTROL, 19, 91, 149  
ACTIVITY CYCLES (BIOLOGY), 136  
ACTUATORS, 69  
ADDITIVES, 43, 52  
ADVANCED COMPOSITION  
EXPLORER, 179  
AEROACOUSTICS, 2, 69, 91  
AERODYNAMIC CHARACTER-  
ISTICS, 3, 4  
AERODYNAMIC CONFIGURATIONS,  
4, 5  
AERODYNAMIC HEATING, 1  
AERODYNAMIC STABILITY, 6  
AERODYNAMIC STALLING, 5, 19  
AERODYNAMICS, 3  
AEROELASTICITY, 2, 19  
AERONAUTICS, 6  
AEROSERVOELASTICITY, 14  
AEROSOLS, 90, 91, 95, 99  
AEROSPACE ENGINEERING, 27, 37  
AEROSPACE ENVIRONMENTS, 31, 133  
AEROSPACE INDUSTRY, 27  
AEROSPACE MEDICINE, 126, 129, 161, 181  
AEROSPACE SCIENCES, 20, 21, 181  
AEROSPACE SYSTEMS, 20  
AEROSPACE TECHNOLOGY TRANS-  
FER, 12, 30, 46, 125, 126, 136, 138, 160, 161, 181

AEROTHERMODYNAMICS, 26  
AGGREGATES, 155  
AGING (BIOLOGY), 103, 108, 129  
AIR MASSES, 94  
AIR POLLUTION, 52, 90, 91, 92, 94  
AIR QUALITY, 52, 92  
AIR TRAFFIC CONTROL, 7, 8, 9, 10, 11, 63  
AIR TRANSPORTATION, 7, 8  
AIRBORNE EQUIPMENT, 9, 11, 22  
AIRCRAFT ACCIDENTS, 9  
AIRCRAFT APPROACH SPACING, 8, 9, 11  
AIRCRAFT COMMUNICATION, 63  
AIRCRAFT CONFIGURATIONS, 19  
AIRCRAFT DESIGN, 14  
AIRCRAFT ENGINES, 18  
AIRCRAFT EQUIPMENT, 82  
AIRCRAFT ICING, 4  
AIRCRAFT MAINTENANCE, 15  
AIRCRAFT MANEUVERS, 19  
AIRCRAFT MODELS, 7, 19  
AIRCRAFT PARTS, 15  
AIRCRAFT RELIABILITY, 14  
AIRCRAFT SPIN, 6  
AIRCRAFT STRUCTURES, 91  
AIRCRAFT WAKES, 3  
AIRFOIL PROFILES, 13  
AIRFOILS, 4  
AIRPORTS, 10, 11  
AIRSPACE, 8, 11  
ALASKA, 86  
ALGORITHMS, 5, 72, 78, 142, 149  
ALKYL COMPOUNDS, 59  
ALLUVIUM, 86  
ALTITUDE SIMULATION, 122  
ALUMINUM, 14, 51, 150, 152  
ALUMINUM ALLOYS, 84  
ALUMINUM GALLIUM ARSENIDES,  
39, 66, 76  
AMBIENT TEMPERATURE, 42  
AMINES, 59  
AMMUNITION, 154  
ANGLE OF ATTACK, 4  
ANGULAR MOMENTUM, 94  
ANIONS, 34, 42, 48, 59  
ANISOTROPIC PLATES, 36, 83  
ANNEALING, 48  
ANNUAL VARIATIONS, 93  
ANOMALIES, 174  
ANTENNA ARRAYS, 66, 67

ANTENNAS, 67  
ANTIGENS, 101, 131  
ANTIINFECTIVES AND ANTIBAC-  
TERIALS, 125  
ANTIMONY, 38  
APOPTOSIS, 105, 111, 112  
APPLICATIONS PROGRAMS (COM-  
PUTERS), 8, 9, 11, 12, 16, 29, 62, 83, 129, 141, 146  
AQUIFERS, 33  
ARC HEATING, 157  
ARC JET ENGINES, 29  
ARCHITECTURE (COMPUTERS), 82, 140, 144, 148  
ARGON, 48, 152  
ARMED FORCES, 145, 155  
ARMED FORCES (UNITED STATES), 141  
AROMATIC COMPOUNDS, 72  
ARTIFICIAL INTELLIGENCE, 27, 61, 62, 143, 146  
ARTIFICIAL SATELLITES, 28  
ASSESSMENTS, 29  
ASSOCIATION REACTIONS, 47  
ASTEROIDS, 171, 172  
ASTRONAUTICS, 6  
ASTRONAUTS, 20, 133, 135, 136  
ASTRONOMICAL MODELS, 171  
ATMOSPHERIC CHEMISTRY, 92  
ATMOSPHERIC EFFECTS, 156  
ATMOSPHERIC LASERS, 77  
ATMOSPHERIC MODELS, 26, 93, 98  
ATMOSPHERIC PHYSICS, 98, 180  
ATMOSPHERIC SOUNDING, 98  
ATOM OPTICS, 78  
ATOMS, 49, 155  
ATTACKING (ASSAULTING), 85  
ATTITUDE (INCLINATION), 84  
ATTITUDE CONTROL, 14, 68  
AUGMENTATION, 10  
AUTOMATIC CONTROL, 8, 10, 11, 16, 141, 148  
AUTOMATION, 8  
AUTOMOBILES, 6  
AUTONOMY, 27  
AVALANCHES, 65  
AVIONICS, 16  
AZOLES, 42

## B

BACTERIA, 124, 125

BAGGAGE, 109  
 BASALT, 97  
 BEAM SPLITTERS, 153  
 BEAM STEERING, 65  
 BEAMS (SUPPORTS), 81  
 BETA PARTICLES, 116  
 BINARY STARS, 168  
 BIODYNAMICS, 137  
 BIOINSTRUMENTATION, 112  
 BIOLOGICAL EFFECTS, 80  
 BIOMARKERS, 105  
 BIOMASS, 87  
 BIOREACTORS, 123  
 BIOTECHNOLOGY, 80  
 BLACK HOLES (ASTRONOMY), 169  
 BLOOD, 130  
 BLOOD PRESSURE, 136  
 BLOOD VESSELS, 133  
 BLUEPRINTS, 87  
 BOATS, 140  
 BODY FLUIDS, 134  
 BODY-WING CONFIGURATIONS, 3, 71  
 BOLTZMANN TRANSPORT EQUATION, 151  
 BONE DEMINERALIZATION, 134  
 BONES, 105, 122, 129  
 BORON, 41, 50, 156  
 BORON NITRIDES, 159  
 BOUNDARY CONDITIONS, 69  
 BOUNDARY LAYER FLOW, 69  
 BOUNDARY LAYER SEPARATION, 73  
 BOUNDARY LAYER TRANSITION, 3, 70  
 BOUNDARY LAYERS, 150  
 BRAIN, 134  
 BREMSSTRAHLUNG, 161  
 BROADBAND, 67, 162, 178  
 BROMIDES, 86  
 BRYOPHYTES, 123  
 BUCKLING, 35, 83  
 BUILDINGS, 61, 92  
 BUOYANCY, 180

## C

C-2 AIRCRAFT, 15  
 CALCIFICATION, 104, 111  
 CALCIUM, 134  
 CALCULI, 135  
 CALIBRATING, 154  
 CALORIC REQUIREMENTS, 93, 99  
 CAMERAS, 76, 148  
 CANCELLATION, 144  
 CANCER, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 126, 127, 128, 129, 130, 131  
 CANOPIES (VEGETATION), 162  
 CARBIDES, 97  
 CARBON, 49, 50, 56, 159  
 CARBON COMPOUNDS, 38, 41  
 CARBON CYCLE, 157  
 CARBON DIOXIDE, 55  
 CARBON FIBER REINFORCED PLASTICS, 36  
 CARBON MONOXIDE, 40, 41, 49, 50  
 CARBON NANOTUBES, 43, 158  
 CARBONYL COMPOUNDS, 49  
 CARCINOGENS, 115, 116, 129  
 CARDIOVASCULAR SYSTEM, 133, 136  
 CARTESIAN COORDINATES, 150  
 CATAclysmic VARIABLES, 168  
 CATALYSTS, 44  
 CATIONS, 38, 49  
 CAVITIES, 69  
 CELL DIVISION, 111  
 CELLS (BIOLOGY), 101, 103, 104, 105, 107, 110, 111, 114, 119, 120, 123, 124, 127  
 CENSORED DATA (MATHEMATICS), 128  
 CEREBRUM, 134  
 CHANNEL FLOW, 69  
 CHEMICAL ANALYSIS, 33  
 CHEMICAL COMPOSITION, 34, 169  
 CHEMICAL REACTIONS, 68  
 CHEMOTHERAPY, 104, 122  
 CHESAPEAKE BAY (US), 93  
 CHIRP, 67  
 CHLORINE, 159  
 CHLOROPHYLLS, 99  
 CHORDS (GEOMETRY), 17  
 CHROMOSOMES, 106, 118, 129  
 CIRCULAR POLARIZATION, 156  
 CIVIL AVIATION, 7  
 CLIMATOLOGY, 93, 94  
 CLINICAL MEDICINE, 129, 132  
 CLOSED ECOLOGICAL SYSTEMS, 137  
 CLOUD COVER, 96, 180  
 CLOUD PHYSICS, 93, 96, 99, 180  
 CLOUD-TO-CLOUD DISCHARGES, 171  
 CLOUDS (METEOROLOGY), 99  
 CMOS, 76  
 COASTS, 93  
 COATINGS, 52  
 COCKPITS, 14  
 COHENITE, 97  
 COLD GAS, 165, 168  
 COLLISIONS, 153  
 COLOR, 76  
 COLUMBIA (ORBITER), 20, 21, 24, 25, 26  
 COMBUSTION, 30, 94  
 COMBUSTION CHAMBERS, 37, 70, 94  
 COMBUSTION PHYSICS, 18, 45, 46, 69  
 COMETS, 173  
 COMMAND AND CONTROL, 82  
 COMMANDS, 144  
 COMMERCE, 146  
 COMMERCIAL OFF-THE-SHELF PRODUCTS, 140, 144  
 COMMUNICATION EQUIPMENT, 157  
 COMMUNICATION NETWORKS, 64  
 COMPLEX VARIABLES, 143  
 COMPOSITE MATERIALS, 35, 36, 73, 80, 153  
 COMPOSITE STRUCTURES, 16, 53  
 COMPRESSOR BLADES, 17  
 COMPRESSOR ROTORS, 17  
 COMPRESSORS, 81  
 COMPUTATIONAL CHEMISTRY, 50, 58  
 COMPUTATIONAL FLUID DYNAMICS, 1, 2, 3, 5, 29, 37, 70, 71, 72, 141, 143, 150  
 COMPUTATIONAL GRIDS, 142, 150  
 COMPUTER AIDED DESIGN, 71  
 COMPUTER ASSISTED INSTRUCTION, 146  
 COMPUTER GRAPHICS, 158  
 COMPUTER INFORMATION SECURITY, 139, 140, 146, 147  
 COMPUTER NETWORKS, 53, 142, 145, 146, 147, 148  
 COMPUTER PROGRAMMING, 64  
 COMPUTER PROGRAMS, 1, 13, 23, 36, 70, 89, 92, 140  
 COMPUTER SYSTEMS PROGRAMS, 16, 139, 141, 146  
 COMPUTER VISION, 148, 149  
 COMPUTERIZED SIMULATION, 7, 8, 61, 68, 69, 83, 100, 129, 144, 152  
 COMPUTERS, 139  
 CONCENTRATORS, 30  
 CONFERENCES, 36, 49, 67, 153  
 CONSERVATION, 100  
 CONSUMABLES (SPACECREW SUPPLIES), 137  
 CONTAMINATION, 31, 68  
 CONTINUOUS WAVE LASERS, 80  
 CONTINUUM FLOW, 37  
 CONTINUUM MODELING, 158  
 CONTROL, 74  
 CONTROL SYSTEMS DESIGN, 149

CONTROLLABILITY, 14  
 CONTROLLERS, 91  
 CONVERTERS, 50  
 COPPER, 45, 157  
 CORAL REEFS, 100  
 CORONAS, 75, 180  
 COSMOLOGY, 97  
 COSTS, 86  
 CRACK PROPAGATION, 35, 84, 153  
 CRATERING, 173  
 CRATERS, 174  
 CREW WORKSTATIONS, 14  
 CRITICAL POINT, 75  
 CROSS CORRELATION, 179  
 CRYOGENIC COOLING, 81  
 CRYOGENIC ROCKET PROPELLANTS, 40, 56  
 CRYOGENIC TEMPERATURE, 64  
 CRYOGENICS, 49, 50, 155  
 CRYSTAL GROWTH, 160  
 CRYSTAL STRUCTURE, 34, 38, 39, 44, 59, 159  
 CRYSTALLIZATION, 160  
 CYCLIC COMPOUNDS, 48, 56, 119  
 CYLINDRICAL BODIES, 14, 150  
 CYTOLOGY, 131

## D

DAMAGE ASSESSMENT, 23  
 DAMPING, 81  
 DATA ACQUISITION, 82, 177, 179  
 DATA BASES, 85, 100  
 DATA PROCESSING, 96, 139, 180  
 DATA STORAGE, 28, 32  
 DEBONDING (MATERIALS), 73  
 DECISION MAKING, 148  
 DECISION SUPPORT SYSTEMS, 145  
 DECOMPOSITION, 55, 84  
 DECOMPRESSION SICKNESS, 122  
 DEFENSE PROGRAM, 15  
 DEFORMATION, 97  
 DEGRADATION, 115  
 DEIMOS, 172  
 DELAMINATING, 35  
 DELTA WINGS, 5  
 DEOXYRIBONUCLEIC ACID, 101, 105, 112  
 DEPOSITION, 50  
 DESALINIZATION, 86  
 DESIGN ANALYSIS, 13, 157  
 DESIGN OPTIMIZATION, 13, 17  
 DESTRUCTION, 58  
 DETECTION, 104, 128, 154, 177  
 DETECTORS, 77, 78  
 DIAGNOSIS, 106, 107, 130

DIATOMIC MOLECULES, 152  
 DIFFERENTIATORS, 72  
 DIGITAL CAMERAS, 77  
 DIGITAL DATA, 164, 175  
 DIGITAL SYSTEMS, 164  
 DIMENSIONAL MEASUREMENT, 84, 88  
 DIODES, 157  
 DIRECT NUMERICAL SIMULATION, 26  
 DIRECTIONAL CONTROL, 19  
 DISCRETIZATION (MATHEMATICS), 72, 143  
 DISEASES, 123, 128  
 DISPLACEMENT, 30  
 DISPLAY DEVICES, 89  
 DISSOCIATION, 41  
 DISTRIBUTED PROCESSING, 62  
 DOPED CRYSTALS, 34, 40, 43, 50, 79  
 DOSAGE, 127  
 DRAG, 71  
 DRAINAGE, 175  
 DRUGS, 107, 108, 119, 160, 181  
 DYNAMIC MODELS, 30  
 DYNAMIC PRESSURE, 17  
 DYNAMIC RESPONSE, 16  
 DYNAMIC STABILITY, 5, 19

## E

EARTH ATMOSPHERE, 60, 156  
 EARTH GRAVITATION, 124, 133  
 EARTH LIMB, 95  
 EARTH ORBITAL ENVIRONMENTS, 31  
 EARTH SCIENCES, 22, 87  
 EARTH SURFACE, 175  
 ECLIPTIC, 173  
 ECONOMIC IMPACT, 52  
 ECOSYSTEMS, 100  
 EDUCATION, 47, 63, 87, 102, 126, 139, 144, 146, 147, 152, 163  
 EIGENVECTORS, 155  
 ELASTIC PROPERTIES, 83  
 ELECTRIC BRIDGES, 159  
 ELECTRIC COILS, 67  
 ELECTRIC CURRENT, 51  
 ELECTRIC POTENTIAL, 51  
 ELECTRICAL RESISTIVITY, 51  
 ELECTRO-OPTICS, 53, 157  
 ELECTRODYNAMICS, 161  
 ELECTROMAGNETIC INTERFERENCE, 63  
 ELECTROMAGNETISM, 153  
 ELECTRON DENSITY (CONCENTRATION), 162  
 ELECTRON MICROSCOPES, 65

ELECTRONIC EQUIPMENT, 64  
 ELECTRONIC STRUCTURE, 41, 161  
 EMBRYOLOGY, 105  
 EMERGENCIES, 85, 146  
 EMISSION, 52, 94  
 EMISSION SPECTRA, 166, 167, 168, 169, 170  
 ENDOTHELIUM, 120  
 ENDOTHERMIC REACTIONS, 44  
 ENERGY GAPS (SOLID STATE), 155  
 ENGINE DESIGN, 17  
 ENGINES, 94  
 ENHANCED VISION, 158  
 ENVIRONMENTAL CONTROL, 100  
 ENVIRONMENTAL MONITORING, 100  
 ENZYME ACTIVITY, 121  
 ENZYMES, 102, 119, 131  
 EPIDEMIOLOGY, 106  
 EPITAXY, 159  
 EPITHELIUM, 106, 107  
 EROSION, 175  
 ERROR ANALYSIS, 150  
 ESCHERICHIA, 119  
 ESTERS, 34  
 ESTROGENS, 103, 104, 116, 117, 130  
 ETHERS, 72  
 ETIOLOGY, 110  
 EUROPA, 176  
 EUROPEAN SPACE AGENCY, 160, 178  
 EVALUATION, 33, 116, 158, 164  
 EXHAUST EMISSION, 90, 92, 95  
 EXOBIOLOGY, 176  
 EXOSKELETONS, 137  
 EXPERT SYSTEMS, 155  
 EXPLORATION, 176  
 EXPLOSIVES, 59  
 EXTRATERRESTRIAL MATTER, 169  
 EYE PROTECTION, 79

## F

F-18 AIRCRAFT, 5  
 FABRICATION, 37, 54, 65, 157, 159  
 FABRICS, 53  
 FACILITIES, 145  
 FACTORIAL DESIGN, 4  
 FATIGUE (MATERIALS), 84  
 FAULT DETECTION, 82  
 FEASIBILITY ANALYSIS, 9, 27  
 FEEDBACK CONTROL, 69  
 FEMALES, 132  
 FERROELECTRIC MATERIALS, 64, 67, 158  
 FERROELECTRICITY, 159  
 FIBER ORIENTATION, 83



FIBROBLASTS, 119  
 FIELD THEORY (PHYSICS), 41  
 FIGHTER AIRCRAFT, 3, 15  
 FILMS, 37  
 FINITE DIFFERENCE THEORY, 74  
 FINITE ELEMENT METHOD, 36, 150  
 FINITE VOLUME METHOD, 73  
 FIRE FIGHTING, 46  
 FIRE PREVENTION, 61  
 FLAME HOLDERS, 18  
 FLAME PROPAGATION, 18  
 FLAMES, 46  
 FLEXIBILITY, 33  
 FLEXIBLE BODIES, 81  
 FLIGHT CONTROL, 27  
 FLIGHT CREWS, 20, 79  
 FLIGHT MANAGEMENT SYSTEMS, 8, 9, 11  
 FLIGHT OPERATIONS, 8, 10  
 FLIGHT SAFETY, 9  
 FLIGHT TESTS, 4, 19, 82  
 FLOOD PLAINS, 87  
 FLOODS, 87  
 FLOW CHARACTERISTICS, 47  
 FLOW DISTRIBUTION, 5, 68, 74, 175  
 FLOW NOISE, 74  
 FLOW VELOCITY, 70  
 FLUID FLOW, 74  
 FLUID MECHANICS, 47  
 FLUORIDES, 159  
 FLUORINE, 57, 159  
 FLUORINE COMPOUNDS, 48, 49, 161  
 FLUTTER, 13  
 FLUTTER ANALYSIS, 2  
 FOCAL PLANE DEVICES, 66, 76, 77  
 FOLIC ACID, 109  
 FOOD PRODUCTION (IN SPACE), 137  
 FORECASTING, 87, 98  
 FORESTS, 87  
 FOSSILS, 177  
 FRACTURE MECHANICS, 73, 83, 84  
 FRACTURE STRENGTH, 83  
 FRACTURING, 35  
 FRAGMENTATION, 60  
 FREE FALL, 60  
 FREQUENCY CONVERTERS, 67  
 FUELS, 87  
 FULLERENES, 43  
 FUNGI, 125

## G

GALACTIC CLUSTERS, 165, 166, 167, 168  
 GALILEAN SATELLITES, 174  
 GALILEO SPACECRAFT, 176

GAME THEORY, 152  
 GAS DETECTORS, 76  
 GAS FLOW, 47, 157  
 GAS GIANT PLANETS, 173, 175  
 GAS IONIZATION, 47  
 GAS TURBINE ENGINES, 18  
 GAS TURBINES, 18  
 GASES, 62  
 GENE EXPRESSION, 113  
 GENE THERAPY, 120  
 GENES, 115, 117, 130  
 GENETIC ALGORITHMS, 16, 143, 173  
 GENETICS, 103, 106, 113, 118, 121, 131  
 GEOCHEMISTRY, 177  
 GEOLOGICAL FAULTS, 97  
 GEOLOGICAL SURVEYS, 33  
 GEOLOGY, 86  
 GLACIERS, 86  
 GLOBAL POSITIONING SYSTEM, 181  
 GLUTATHIONE, 119  
 GOVERNMENTS, 163  
 GRADIOMETERS, 78  
 GRANULAR MATERIALS, 45  
 GRAPHITE-EPOXY COMPOSITES, 79  
 GRAVITATION, 78  
 GRAVITATIONAL EFFECTS, 60, 123  
 GRAVITATIONAL FIELDS, 94  
 GRAZING FLOW, 2  
 GRID GENERATION (MATHEMATICS), 4, 150  
 GRIDS, 140  
 GROUND OPERATIONAL SUPPORT SYSTEM, 27  
 GROUND WATER, 33, 86  
 GROWTH, 106, 107, 113, 119, 125

## H

HALL THRUSTERS, 32  
 HALOCARBONS, 49  
 HALOGEN COMPOUNDS, 43  
 HARDWARE, 143  
 HAWAII, 87  
 HAZARDOUS MATERIALS, 33  
 HEALING, 129  
 HEALTH, 13, 132  
 HEART FUNCTION, 136  
 HEAT FLUX, 162  
 HEAT MEASUREMENT, 55  
 HEAT SINKS, 162  
 HELICOPTERS, 6, 14  
 HELIUM IONS, 170  
 HELMET MOUNTED DISPLAYS, 138  
 HEMATOPOIETIC SYSTEM, 110  
 HEMORRHAGES, 108  
 HIGH ENERGY ELECTRONS, 161

HIGH ENERGY PROPELLANTS, 40, 50, 56, 57, 58, 59  
 HIGH FREQUENCIES, 100  
 HIGH POWER LASERS, 23  
 HIGH RESOLUTION, 34, 50, 76, 165, 167, 168, 170  
 HISTOCHEMICAL ANALYSIS, 112  
 HOLE BURNING, 32  
 HOLE GEOMETRY (MECHANICS), 2  
 HOLOGRAPHY, 77  
 HOMOTOPY THEORY, 16  
 HONEYCOMB STRUCTURES, 15  
 HORMONE METABOLISMS, 113  
 HORMONES, 103, 108, 116, 117  
 HUMAN BODY, 103, 132, 134, 135  
 HUMAN REACTIONS, 117  
 HUMAN-COMPUTER INTERFACE, 129, 148  
 HYBRID PROPULSION, 37, 70  
 HYDRATION, 171  
 HYDRAZINES, 29, 41, 55, 58  
 HYDROCARBON FUELS, 57  
 HYDROCARBONS, 50, 57  
 HYDRODYNAMICS, 23, 151  
 HYDROGEN, 40, 170, 172  
 HYDROGEN FUELS, 37  
 HYDROLOGY, 85  
 HYDROPHONES, 154  
 HYPERSONIC VEHICLES, 15  
 HYPOTHESES, 116

## I

ICE, 174, 175  
 IGNEOUS ROCKS, 97  
 IGNITION, 18  
 IMAGE PROCESSING, 149, 158  
 IMAGERY, 78, 107  
 IMAGING SPECTROMETERS, 77, 177, 178  
 IMAGING TECHNIQUES, 62, 77, 113, 155, 167, 168, 178  
 IMIDES, 72  
 IMMUNE SYSTEMS, 124, 134  
 IMMUNOLOGY, 131  
 IMPACT, 14  
 IMPACT DAMAGE, 23  
 IMPACT RESISTANCE, 44  
 IMPACT VELOCITY, 14  
 IMPROVEMENT, 163  
 IMPURITIES, 157  
 IN VITRO METHODS AND TESTS, 113  
 INCIDENT RADIATION, 180  
 INCOMPRESSIBLE FLOW, 69  
 INDIUM GALLIUM ARSENIDES, 39, 65

INDUCTANCE, 67  
 INFECTIOUS DISEASES, 116, 124  
 INFLATABLE STRUCTURES, 30  
 INFORMATION ANALYSIS, 147  
 INFORMATION MANAGEMENT, 146, 148  
 INFORMATION RESOURCES MANAGEMENT, 20  
 INFORMATION SYSTEMS, 126, 146, 148, 164  
 INFRARED ABSORPTION, 40, 43  
 INFRARED ASTRONOMY, 172  
 INFRARED DETECTORS, 39, 66  
 INFRARED IMAGERY, 88  
 INFRARED RADIATION, 43, 66, 76, 89, 156, 161, 162, 170  
 INFRARED SPECTRA, 34, 176  
 INFRARED SPECTROMETERS, 178  
 INFRARED SPECTROSCOPY, 50, 172  
 INHIBITORS, 104  
 INLET FLOW, 17  
 INSTRUMENT FLIGHT RULES, 11  
 INSTRUMENTS, 62  
 INSULIN, 114  
 INTEGRATED CIRCUITS, 148  
 INTERCALIBRATION, 179  
 INTERFACIAL TENSION, 160  
 INTERFEROMETERS, 78, 178  
 INTERFERON, 127  
 INTERNAL COMBUSTION ENGINES, 94  
 INTERPLANETARY DUST, 171  
 INTERSYMBOLIC INTERFERENCE, 65  
 INTRAVEHICULAR ACTIVITY, 26  
 INVESTIGATION, 106  
 IODINE COMPOUNDS, 48  
 ION BEAMS, 65  
 ION EXCHANGING, 34  
 IONIC REACTIONS, 47  
 IONIZATION, 34, 42, 47  
 IONIZATION POTENTIALS, 169  
 IONIZED GASES, 47  
 IONOSPHERES, 98  
 IONOSPHERIC DISTURBANCES, 95  
 IRIS SATELLITES, 178  
 IRON METEORITES, 97  
 ISOELECTRONIC SEQUENCE, 43  
 ISRAELI SPACE PROGRAM, 95

## J

JAPAN, 98  
 JAVA (PROGRAMMING LANGUAGE), 173  
 JET ENGINE FUELS, 68

JOINTS (ANATOMY), 137  
 JOINTS (JUNCTIONS), 29  
 JUPITER SATELLITES, 173, 175

## K

KAMACITE, 97  
 KIDNEYS, 135  
 KINEMATICS, 132  
 KINETICS, 50, 132, 134, 151

## L

LAMINAR FLOW, 70, 96  
 LAMINATES, 35, 36, 83  
 LARGE EDDY SIMULATION, 69, 70  
 LASER BEAMS, 79  
 LASER MATERIALS, 79, 80  
 LASER PROPULSION, 23  
 LASER SPECTROSCOPY, 79  
 LASERS, 80, 157  
 LATERAL CONTROL, 19  
 LAUNCH VEHICLES, 28  
 LAUNCHING, 22, 23  
 LAVA, 175  
 LEADING EDGES, 69  
 LENGTH, 17  
 LEUKOCYTES, 127  
 LIBRARIES, 164  
 LIFE (DURABILITY), 82  
 LIFE SCIENCES, 20, 123, 175  
 LIGANDS, 103, 117  
 LIGHT (VISIBLE RADIATION), 60, 169  
 LIGHT ELEMENTS, 166  
 LIGHT EMISSION, 169  
 LIGHT EMITTING DIODES, 33, 155  
 LINE SPECTRA, 167, 169, 170  
 LINEAR POLARIZATION, 156  
 LININGS, 2  
 LIQUID CRYSTALS, 158  
 LIQUIDS, 59  
 LITHIUM, 86  
 LITHIUM NIOBATES, 161  
 LITHOSPHERE, 97  
 LOAD CARRYING CAPACITY, 52  
 LOAD DISTRIBUTION (FORCES), 142  
 LOADING, 14  
 LOADS (FORCES), 13, 84  
 LOGIC CIRCUITS, 143  
 LOGISTICS, 21  
 LONG TERM EFFECTS, 85  
 LOW MOLECULAR WEIGHTS, 130  
 LOW REYNOLDS NUMBER, 31  
 LOW TEMPERATURE, 153  
 LUBRICANTS, 52  
 LUNAR PROSPECTOR, 173

LUNAR SURFACE, 174  
 LUNGS, 136  
 LYMAN ALPHA RADIATION, 166  
 LYMPHOCYTES, 131

## M

MACH NUMBER, 15  
 MAGELLANIC CLOUDS, 166, 168  
 MAGNETIC FIELDS, 124, 162  
 MAGNETIC RESONANCE, 120  
 MAMMALS, 105  
 MAMMARY GLANDS, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 127, 128, 130, 131  
 MANAGEMENT, 163, 164  
 MANAGEMENT INFORMATION SYSTEMS, 144, 148, 163  
 MANAGEMENT PLANNING, 10, 93, 147  
 MANNED SPACE FLIGHT, 21, 124, 133, 134  
 MANUALS, 140  
 MANUFACTURING, 33, 64, 158  
 MARINE ENVIRONMENTS, 99  
 MARINER SPACECRAFT, 178  
 MARS (PLANET), 89, 178  
 MARS ATMOSPHERE, 89  
 MARS ENVIRONMENT, 78  
 MARS EXPLORATION, 176, 177, 178  
 MARS SURFACE, 78, 89, 97, 175, 176, 177, 178, 179  
 MARS VOLCANOES, 97  
 MASS DISTRIBUTION, 94  
 MASS SPECTROSCOPY, 34, 42  
 MATERIALS SCIENCE, 50  
 MATERIALS SELECTION, 160  
 MATHEMATICAL MODELS, 4, 19, 32, 37, 61, 65, 69, 70, 81, 141, 147, 150, 151, 158, 162, 171  
 MATHEMATICS, 139  
 MATRICES (MATHEMATICS), 53  
 MAXIMUM LIKELIHOOD ESTIMATES, 153  
 MEASUREMENT, 100, 169  
 MEASURING INSTRUMENTS, 13  
 MECHANICAL ENGINEERING, 82  
 MECHANICAL PROPERTIES, 34, 45, 81, 84, 158  
 MEDICAL EQUIPMENT, 107  
 MEMBRANES, 34  
 MENSTRUATION, 114  
 METABOLIC DISEASES, 104  
 METABOLISM, 109  
 METAL BONDING, 161

METAL FLUORIDES, 39  
 METALS, 37  
 METASTASIS, 105, 112, 114, 121, 122, 130, 131  
 METEORITIC COMPOSITION, 97  
 METEOROLOGICAL PARAMETERS, 98  
 METHANE, 34  
 METHODOLOGY, 62  
 METHYL COMPOUNDS, 176  
 METHYLATION, 128  
 METHYLENE, 44  
 METROLOGY, 77  
 MICROCHANNELS, 162  
 MICROCOMPUTERS, 152  
 MICROGRAVITY, 20, 23, 25, 45, 46, 96, 123, 124, 125, 133, 134, 181  
 MICROGRAVITY APPLICATIONS, 24  
 MICROSTRUCTURE, 34, 37  
 MILITARY AIRCRAFT, 17, 19  
 MILITARY OPERATIONS, 137  
 MILITARY TECHNOLOGY, 77, 82, 145, 147, 165  
 MINERALOGY, 77, 78, 171, 177, 178  
 MIRRORS, 28, 76  
 MISSISSIPPI RIVER (US), 89  
 MISSOURI RIVER (US), 89  
 MIST, 46  
 MITOSIS, 118  
 MODAL RESPONSE, 14  
 MODELS, 8, 30, 65  
 MODULUS OF ELASTICITY, 31  
 MOISTURE CONTENT, 171  
 MOLECULAR BEAMS, 68  
 MOLECULAR BIOLOGY, 105  
 MOLECULAR DYNAMICS, 50, 59, 60  
 MOLECULAR ELECTRONICS, 159  
 MOLECULAR INTERACTIONS, 47  
 MOLECULAR STRUCTURE, 130  
 MOLECULAR WEIGHT, 55  
 MOMENTS OF INERTIA, 132  
 MONITORS, 13, 86  
 MONOMERS, 54  
 MONOPROPELLANTS, 55, 56  
 MONTE CARLO METHOD, 26, 60, 68, 152, 173  
 MORPHOLOGY, 175  
 MOTION, 81  
 MOTION PICTURES, 148  
 MULTIBLOCK GRIDS, 4  
 MULTIPROCESSING (COMPUTERS), 62, 142, 151  
 MULTISPECTRAL LINEAR ARRAYS, 66  
 MUSCLES, 135  
 MUSCULOSKELETAL SYSTEM, 134

MUTAGENESIS, 129  
 MUTATIONS, 111, 114, 121  
**N**  
 N-TYPE SEMICONDUCTORS, 72  
 NACELLES, 2  
 NANOSATELLITES, 23, 27  
 NANOSTRUCTURE GROWTH, 159  
 NANOTUBES, 159  
 NASA PROGRAMS, 3, 181  
 NASA SPACE PROGRAMS, 21, 87  
 NATIONAL AIRSPACE SYSTEM, 7, 9, 10  
 NATIONAL PARKS, 86  
 NATURAL GAS, 87  
 NATURAL LANGUAGE (COMPUTERS), 143  
 NAVIER-STOKES EQUATION, 1, 73  
 NAVIGATION, 140  
 NAVY, 152  
 NEGATIVE IONS, 34  
 NEOPLASMS, 121  
 NETWORK ANALYSIS, 147  
 NEUTRON SCATTERING, 34  
 NEUTRON STARS, 165  
 NEUTRONS, 165  
 NIGHT VISION, 158  
 NITRATES, 48  
 NITRIDES, 47  
 NITROGEN COMPOUNDS, 34, 44, 55, 56, 57, 59, 60  
 NITROGEN FLUORIDES, 44  
 NITROGEN OXIDES, 40  
 NOISE PREDICTION, 2  
 NOISE REDUCTION, 74, 91  
 NONDESTRUCTIVE TESTS, 35, 36, 61, 63  
 NONLINEAR OPTICS, 67  
 NONLINEAR SYSTEMS, 15  
 NONLINEARITY, 68  
 NUCLEAR MAGNETIC RESONANCE, 42, 44, 62  
 NUCLEIC ACIDS, 119  
 NUMERICAL ANALYSIS, 2, 14, 30, 70, 173  
 NUTRITION, 137  
 NUTRITIONAL REQUIREMENTS, 93

**O**  
 OBSERVATION, 165  
 OCCUPATION, 126  
 OCEAN CURRENTS, 74, 100  
 OCEAN DYNAMICS, 100  
 OCEAN MODELS, 93, 100  
 OCEAN SURFACE, 100, 175

OCEANOGRAPHY, 99  
 OCEANS, 99, 157  
 OILS, 52, 86  
 OKLAHOMA, 86  
 ONBOARD DATA PROCESSING, 178  
 ONBOARD EQUIPMENT, 177  
 ONCOGENES, 102, 105, 113  
 OPERATING TEMPERATURE, 41  
 OPERATIONS RESEARCH, 152  
 OPTICAL COMMUNICATION, 77  
 OPTICAL CONTROL, 157  
 OPTICAL DATA PROCESSING, 32  
 OPTICAL DATA STORAGE MATERIALS, 32  
 OPTICAL EQUIPMENT, 81  
 OPTICAL MATERIALS, 53  
 OPTICAL MEMORY (DATA STORAGE), 32  
 OPTICAL PROPERTIES, 157  
 OPTICAL RADAR, 99, 157  
 OPTIMIZATION, 10, 16, 69, 143, 173  
 ORBIT MANEUVERING ENGINE (SPACE SHUTTLE), 95  
 ORDER-DISORDER TRANSFORMATIONS, 44  
 ORGANIC COMPOUNDS, 88, 91, 92  
 ORGANIC MATERIALS, 32, 53  
 ORGANIC PHOSPHORUS COMPOUNDS, 34  
 ORGANIC SEMICONDUCTORS, 33  
 ORGANS, 106  
 ORTHO HYDROGEN, 50  
 OSCILLATIONS, 30  
 OXIDATION, 39  
 OXIDIZERS, 57  
 OXYGEN, 38, 42  
 OXYGEN CONSUMPTION, 132  
 OZONOMETRY, 95

**P**  
 PAIR PRODUCTION, 161  
 PALEONTOLOGY, 177  
 PANELS, 91  
 PAPERS, 67, 164  
 PARA HYDROGEN, 40, 43, 49, 50, 55  
 PARALLEL PROCESSING (COMPUTERS), 16  
 PARAMETERIZATION, 150  
 PARTICLE IMAGE VELOCIMETRY, 70  
 PARTICULATES, 35, 91, 153  
 PASCAL (PROGRAMMING LANGUAGE), 47  
 PATHOGENESIS, 116  
 PATHOLOGY, 104  
 PATTERN RECOGNITION, 84  
 PAYLOADS, 22

PEPTIDES, 115, 130  
 PERFORMANCE PREDICTION, 147, 164  
 PERFORMANCE TESTS, 13, 33, 61, 139, 158  
 PERSONNEL, 141, 155  
 PERTURBATION THEORY, 41  
 PHARMACOLOGY, 118  
 PHASE MODULATION, 153  
 PHASE TRANSFORMATIONS, 41, 138  
 PHASED ARRAYS, 67  
 PHOBOS, 172  
 PHOSPHORUS, 38, 93  
 PHOSPHORYLATION, 112, 117, 121  
 PHOTOELECTRON SPECTROSCOPY, 155  
 PHOTOELECTRONS, 47  
 PHOTOGRAPHS, 87  
 PHOTOIONIZATION, 42, 60  
 PHOTOMETERS, 39, 65, 66, 76, 162  
 PHOTONS, 54  
 PHOTOREFRACTIVITY, 54  
 PHOTSENSITIVITY, 120  
 PHOTOTROPISM, 123  
 PHOTOVOLTAIC CELLS, 30  
 PHYSICAL EXERCISE, 116, 135  
 PHYSICAL FITNESS, 109  
 PHYSICAL PROPERTIES, 54  
 PHYSIOLOGICAL DEFENSES, 119, 122  
 PHYSIOLOGICAL EFFECTS, 132, 136  
 PHYSIOLOGICAL RESPONSES, 124  
 PHYSIOLOGY, 113, 116  
 PIEZOELECTRIC ACTUATORS, 65  
 PIEZOELECTRICITY, 81  
 PILOTLESS AIRCRAFT, 12  
 PISTONS, 81  
 PITUITARY HORMONES, 117  
 PIXELS, 177  
 PLANAR STRUCTURES, 153  
 PLANETARY ATMOSPHERES, 176  
 PLANETARY GEOLOGY, 78, 97, 175, 176, 177, 178, 180  
 PLANETARY MAGNETIC FIELDS, 175  
 PLANETARY MAPPING, 176, 177  
 PLANETARY NEBULAE, 171  
 PLANETARY SURFACES, 78, 174, 176  
 PLANNING, 85  
 PLANTS (BOTANY), 124  
 PLASMA DENSITY, 75  
 PLASMA TEMPERATURE, 75  
 PLASMAS (PHYSICS), 15  
 PLATEAUS, 180  
 PLUMES, 31  
 POLAR CAPS, 179

POLAR REGIONS, 174, 178, 179  
 POLARIMETRY, 156  
 POLLUTION CONTROL, 86, 94  
 POLYETHYLENES, 55  
 POLYIMIDE RESINS, 31  
 POLYMERS, 54, 80  
 POSITION (LOCATION), 64  
 POTASSIUM, 39, 113  
 POWDERED ALUMINUM, 51  
 POWER SUPPLIES, 28  
 PREDICTION ANALYSIS TECHNIQUES, 2  
 PREDICTIONS, 70, 71, 85, 93, 130  
 PRESIDENTIAL REPORTS, 164  
 PRESSURE DISTRIBUTION, 4, 94  
 PRESSURE OSCILLATIONS, 17  
 PRESSURE RECOVERY, 17  
 PRESSURE REDUCTION, 122  
 PRESSURE SENSORS, 17, 69  
 PREVENTION, 112, 114, 116  
 PROBABILITY THEORY, 13  
 PROBLEM SOLVING, 72, 151  
 PRODUCT DEVELOPMENT, 13  
 PROGRAMMING ENVIRONMENTS, 61  
 PROJECTILES, 51  
 PROPELLANTS, 79  
 PROPULSION, 23, 30, 59  
 PROPULSION SYSTEM CONFIGURATIONS, 31  
 PROPULSION SYSTEM PERFORMANCE, 31  
 PROSTATE GLAND, 123  
 PROTECTION, 20, 116  
 PROTEIN CRYSTAL GROWTH, 126, 160, 161  
 PROTEINS, 130, 135  
 PSYCHOLOGICAL FACTORS, 102  
 PULSED LASERS, 79

## Q

QUALIFICATIONS, 14  
 QUALITY, 163  
 QUALITY CONTROL, 3  
 QUANTUM ELECTRONICS, 80  
 QUANTUM MECHANICS, 50, 55, 60  
 QUANTUM THEORY, 66  
 QUANTUM WELLS, 39, 66, 76, 162

## R

RADAR, 100  
 RADAR ANTENNAS, 66  
 RADAR DATA, 174  
 RADAR EQUIPMENT, 157  
 RADIANCE, 98

RADIANT FLUX DENSITY, 96  
 RADIATION, 105  
 RADIATION ABSORPTION, 180  
 RADIATION DISTRIBUTION, 170  
 RADIATION DOSAGE, 128, 155  
 RADIATION MEASUREMENT, 180  
 RADIATION PROTECTION, 79, 80  
 RADIATION THERAPY, 109, 118  
 RADICALS, 176  
 RADIO EQUIPMENT, 63  
 RADIO FREQUENCIES, 159, 161  
 RADIOMETERS, 28  
 RADIOTELEPHONES, 126  
 RANDOM SIGNALS, 30  
 RANDOM WALK, 151  
 REACTION KINETICS, 48, 176  
 REACTIVITY, 54  
 READING, 139  
 REAL TIME OPERATION, 173  
 RECEPTORS (PHYSIOLOGY), 104  
 RECOGNITION, 84  
 RECORDS MANAGEMENT, 164  
 REFLECTION, 28  
 REFRACTORY METALS, 41  
 REGULATORY MECHANISMS (BIOLOGY), 134  
 REINFORCED PLASTICS, 52  
 RELATIVISTIC EFFECTS, 169  
 REMOTE SENSING, 78, 85, 87, 95, 172, 174, 179, 181  
 REMOTE SENSORS, 154  
 RESEARCH AND DEVELOPMENT, 8, 11, 21, 22, 58, 61, 62, 82, 84, 87, 145, 152, 161, 165, 181  
 RESEARCH FACILITIES, 137  
 RESEARCH MANAGEMENT, 102, 129, 132  
 RESEARCH PROJECTS, 90  
 RESIN TRANSFER MOLDING, 53  
 RESISTANCE, 102, 107  
 RESOLUTION, 169  
 RESONANCE LINES, 170  
 RESOURCES MANAGEMENT, 93  
 RESPIRATORY SYSTEM, 91  
 REVERSE ENGINEERING, 142  
 REYNOLDS NUMBER, 1, 3, 4, 31  
 RHYTHM (BIOLOGY), 99  
 RIBONUCLEIC ACIDS, 113  
 RISK, 128, 163  
 RIVERS, 86  
 ROBUSTNESS (MATHEMATICS), 17  
 ROCKET ENGINES, 30  
 ROCKET EXHAUST, 30  
 ROCKET PROPELLANTS, 58  
 ROCKS, 97  
 RODS, 51



ROTARY WING AIRCRAFT, 14  
RP-1 ROCKET PROPELLANTS, 50  
RUBIDIUM, 39

## S

SAFETY MANAGEMENT, 138  
SALTS, 41, 42, 44, 59, 161  
SAMPLING, 33, 85  
SANDS, 45  
SATELLITE COMMUNICATION, 64  
SATELLITE IMAGERY, 98  
SATELLITE OBSERVATION, 98, 99  
SATELLITE SOUNDING, 98  
SATELLITE-BORNE INSTRUMENTS, 28  
SCALE EFFECT, 3, 142  
SCANNERS, 65, 88  
SCANNING, 77  
SCATTERING, 96, 180  
SCHEDULING, 142  
SCIENTIFIC VISUALIZATION, 61, 143, 173  
SCREENING, 106  
SECURITY, 20, 148, 163  
SEDIMENTS, 88  
SEMICONDUCTOR LASERS, 79, 80  
SEMICONDUCTORS (MATERIALS), 155, 161  
SENSITIVITY, 93  
SENSITIVITY ANALYSIS, 6  
SENSORS, 78  
SEPARATORS, 153  
SERVOMECHANISMS, 14  
SHAPE OPTIMIZATION, 5  
SHEAR STRENGTH, 15  
SHOCK TUBES, 15  
SIGNAL PROCESSING, 63, 64  
SIGNAL TRANSMISSION, 159  
SILICON, 54  
SILICON CARBIDES, 76  
SIMULATION, 2, 7, 30, 84, 145  
SINGLE CRYSTALS, 38, 159, 161  
SKIN (STRUCTURAL MEMBER), 73  
SLEEP, 136  
SMART MATERIALS, 16  
SMOKE, 61  
SOCIAL FACTORS, 102  
SOCIOLOGY, 63  
SOFTWARE DEVELOPMENT TOOLS, 89  
SOFTWARE ENGINEERING, 16, 61, 64, 70, 141, 142, 144, 145  
SOFTWARE REUSE, 142  
SOILS, 85  
SOLAR CORONA, 169

SOLAR ENERGY, 31, 32  
SOLAR RADIATION, 180  
SOLAR SYSTEM, 171  
SOLAR THERMAL PROPULSION, 30, 31, 32  
SOLAR WIND, 179  
SOLID CRYOGENS, 49, 55  
SOLID PHASES, 40, 49  
SOLID PROPELLANT ROCKET ENGINES, 84  
SOLID PROPELLANTS, 55  
SOLID WASTES, 33  
SOLIDIFIED GASES, 48, 49, 55, 56  
SOLIDS, 50  
SOLVENTS, 90  
SONAR, 154  
SOOT, 96  
SOUND DETECTING AND RANGING, 154  
SOUNDING, 95  
SPACE ADAPTATION SYNDROME, 133  
SPACE DEBRIS, 23  
SPACE FLIGHT, 124  
SPACE FLIGHT FEEDING, 137  
SPACE MISSIONS, 21, 22, 25, 27, 99, 137  
SPACE NAVIGATION, 12  
SPACE SHUTTLE BOOSTERS, 22, 29, 52  
SPACE SHUTTLE MISSIONS, 20, 21, 25  
SPACE SHUTTLE PAYLOADS, 20, 21, 126, 160, 181  
SPACE SHUTTLES, 21, 24, 60, 95, 124  
SPACE TRANSPORTATION SYSTEM, 21, 22, 23, 24, 25, 124, 133  
SPACEBORNE EXPERIMENTS, 12, 20, 21, 22, 23, 24, 25, 26, 30, 45, 46, 75, 95, 96, 123, 124, 125, 126, 133, 134, 135, 136, 138, 160, 161, 180, 181  
SPACEBORNE TELESCOPES, 178  
SPACECRAFT, 27  
SPACECRAFT CONSTRUCTION MATERIALS, 23  
SPACECRAFT DESIGN, 27  
SPACECRAFT EQUIPMENT, 22  
SPACECRAFT GUIDANCE, 12  
SPACECRAFT INSTRUMENTS, 22, 77, 78, 177, 178  
SPACECRAFT MODULES, 21, 23, 24, 25, 26  
SPACECRAFT POWER SUPPLIES, 29  
SPACECREWS, 21, 24, 25, 26  
SPECTRA, 75, 165, 169  
SPECTRAL RESOLUTION, 88, 166, 177  
SPECTRAL THEORY, 152

SPECTROGRAPHS, 178  
SPECTROMETERS, 28, 76, 178  
SPECTROPHOTOMETRY, 172  
SPECTROSCOPY, 38, 50, 88, 89, 156, 168, 176, 179  
SPEECH RECOGNITION, 149  
SPIN STABILIZATION, 6  
SPRINGS (ELASTIC), 81  
SPUTTERING, 54  
STABILITY, 5  
STABILIZATION, 5, 38  
STANDARDIZATION, 6  
STANDARDS, 85, 93, 94  
STARK EFFECT, 39  
STARS, 75, 84  
STATISTICAL ANALYSIS, 4, 17, 180  
STATISTICAL DISTRIBUTIONS, 175  
STATISTICAL MECHANICS, 151  
STELLAR ATMOSPHERES, 171  
STELLAR SPECTRA, 170  
STIFFNESS, 73  
STIMULATED EMISSION, 104  
STRAIN DISTRIBUTION, 36  
STRAIN RATE, 153  
STRATIFICATION, 70  
STREAMS, 93  
STRESS (PHYSIOLOGY), 107, 120  
STRESS ANALYSIS, 13  
STRINGERS, 73  
STRUCTURAL DESIGN, 13, 16  
STUDENTS, 24, 126, 139, 163  
SUBSTRATES, 33, 37  
SULFUR COMPOUNDS, 39  
SULFUR DIOXIDES, 39  
SUPERCRITICAL FLOW, 55, 58  
SUPERGIANT STARS, 170  
SUPERNOVA REMNANTS, 166, 167, 169  
SUPERNOVAE, 165, 167  
SUPERSONIC COMBUSTION RAM-JET ENGINES, 18, 37, 70  
SUPERSONIC FLUTTER, 19  
SUPERSONIC WIND TUNNELS, 70  
SUPPRESSORS, 131  
SURFACE ROUGHNESS, 88  
SURFACE TEMPERATURE, 51  
SURFACE VEHICLES, 12  
SURFACE WATER, 33, 86  
SURVEYS, 88, 99, 141, 163  
SUSPENDING (HANGING), 81  
SYMBOLS, 89  
SYNCHRONISM, 153  
SYNCHRONOUS SATELLITES, 29  
SYNTHESIS (CHEMISTRY), 39, 42, 43, 48, 50, 56, 57, 60, 72  
SYNTHETIC FIBERS, 55

SYSTEMS ENGINEERING, 3, 7, 8, 11,  
61, 62, 82  
SYSTEMS HEALTH MONITORING, 82  
SYSTEMS INTEGRATION, 7, 144, 149  
SYSTEMS MANAGEMENT, 165

## T

TABULATION PROCESSES, 141  
TANTALUM, 54  
TARGETS, 117  
TASKS, 142  
TECHNOLOGIES, 7, 10  
TECHNOLOGY ASSESSMENT, 62, 76  
TECHNOLOGY UTILIZATION, 7, 8,  
10, 11, 12, 30, 46, 125, 126, 136,  
138, 146, 160, 161, 181  
TECTONICS, 86  
TELECOMMUNICATION, 63, 77  
TELEMEDICINE, 126  
TELESOPES, 89  
TEMPERATURE CONTROL, 162  
TERMINALS, 10  
TERRA SPACECRAFT, 28  
TERRORISM, 85  
TEST FACILITIES, 17, 61  
TEST STANDS, 150  
TETHERLINES, 23  
THEORIES, 60  
THERAPY, 130  
THERMAL CONDUCTIVITY, 40  
THERMAL EMISSION, 78, 97, 178  
THERMAL ENVIRONMENTS, 29  
THERMAL EXPANSION, 83  
THERMAL MAPPING, 88  
THERMAL PROTECTION, 52  
THERMAL STABILITY, 44  
THERMODYNAMIC PROPERTIES,  
162  
THERMOGRAPHY, 1  
THERMOMETERS, 40, 49, 50  
THERMOSPHERE, 98  
THICKNESS, 174  
THIN FILMS, 31, 159  
THIN WINGS, 3  
THREE DIMENSIONAL MODELS, 65,  
70, 73  
THRUST MEASUREMENT, 30  
THRUST VECTOR CONTROL, 22  
THRUSTORS, 30, 31  
THYROID GLAND, 112  
TIME DEPENDENCE, 65  
TIME OF FLIGHT SPECTROMETERS,  
42  
TISSUES (BIOLOGY), 115  
TOLERANCES (PHYSIOLOGY), 133

TOPOLOGY, 4  
TORQUE, 137  
TOUGHNESS, 83  
TOXICITY, 45, 91  
TOXICOLOGY, 130  
TOXINS AND ANTITOXINS, 124  
TRACE ELEMENTS, 88  
TRAILING EDGES, 2  
TRAINING DEVICES, 144  
TRANSCRIPTION (GENETICS), 101  
TRANSITION FLOW, 70  
TRANSMITTER RECEIVERS, 12  
TRANSONIC COMPRESSORS, 17  
TRANSONIC SPEED, 19  
TRANSONIC WIND TUNNELS, 5  
TRANSPORTATION, 63  
TRAVELING WAVE TUBES, 65  
TREADMILLS, 109  
TREES (PLANTS), 162  
TRIANGULATION, 71  
TROPICAL REGIONS, 96  
TRUCKS, 90, 92  
TUMORS, 112, 113, 115, 116, 129  
TUNABLE LASERS, 79  
TUNGSTEN CARBIDES, 51  
TURBOCOMPRESSORS, 17  
TURBOFAN ENGINES, 17  
TURBULENCE, 3  
TURBULENCE MODELS, 69  
TURBULENT FLOW, 1, 72

## U

UH-60A HELICOPTER, 14  
ULTRASONICS, 104, 111, 113  
ULTRAVIOLET EMISSION, 167  
ULTRAVIOLET RADIATION, 181  
ULTRAVIOLET SPECTRA, 170  
UNDERWATER ACOUSTICS, 154  
UNDERWATER TESTS, 154  
UNIVERSITIES, 163  
UNSTEADY AERODYNAMICS, 5, 19  
UNSTEADY FLOW, 73  
UNSTRUCTURED GRIDS (MATH-  
EMATICS), 72, 73  
UPPER STAGE ROCKET ENGINES, 22  
URINE, 138  
USER MANUALS (COMPUTER PRO-  
GRAMS), 92, 141  
USER REQUIREMENTS, 144

## V

VACUUM, 53  
VACUUM DEPOSITION, 33  
VAPOR DEPOSITION, 37, 40

VAPOR PRESSURE, 41  
VAPORS, 41, 67  
VEGETATION, 85, 88  
VEGETATION GROWTH, 125  
VENTILATION, 92  
VERTICAL TAKEOFF AIRCRAFT, 12,  
17  
VESTIBULAR TESTS, 133  
VIBRATION, 60, 81  
VIBRATION DAMPING, 149  
VIBRATIONAL SPECTRA, 40, 42, 49,  
59  
VIDEO EQUIPMENT, 148  
VIDEO SIGNALS, 164  
VIRAL DISEASES, 134  
VIRTUAL REALITY, 7, 8, 9, 61, 62, 143,  
144  
VIRUSES, 113  
VISCOSITY, 75  
VISUAL PERCEPTION, 138  
VOLATILE ORGANIC COMPOUNDS,  
88, 92  
VORTICES, 3, 5, 70

## W

WAKES, 70  
WALKING, 109, 132  
WATER COLOR, 157  
WATER INJECTION, 74  
WATER MANAGEMENT, 86  
WATER POLLUTION, 93  
WATER QUALITY, 86, 88, 93  
WATER RECLAMATION, 138  
WATER TREATMENT, 86  
WATERSHEDS, 87  
WAVE FUNCTIONS, 152  
WEATHER, 7, 9  
WEIGHT REDUCTION, 28  
WELD STRENGTH, 82  
WELDED JOINTS, 82  
WELLS, 86  
WETLANDS, 85  
WIDEBAND COMMUNICATION, 63  
WIND TUNNEL MODELS, 4  
WIND TUNNEL TESTS, 1, 3, 4, 5, 19,  
71  
WIND TUNNELS, 4, 19  
WIND/GGS SPACECRAFT, 179  
WINDPOWER UTILIZATION, 90  
WING ROCK, 5, 19  
WINGS, 5, 13, 16, 19, 149  
WOOD, 87  
WORDS (LANGUAGE), 139  
WORLD WIDE WEB, 173

## **X**

X RAY ANALYSIS, 161  
X RAY BINARIES, 169  
X RAY IMAGERY, 168  
X RAY IRRADIATION, 169  
X RAY SOURCES, 168  
X RAY SPECTRA, 165, 170  
X RAY SPECTROSCOPY, 75, 166, 167,  
170  
X RAYS, 28, 166, 167, 169  
X-29 AIRCRAFT, 4  
XENON, 75  
XMM-NEWTON TELESCOPE, 28

## **Y**

YEAST, 118

## **Z**

ZEOLITES, 160  
ZINC SELENIDES, 79  
ZODIACAL LIGHT, 171

# Personal Author Index

## A

Aarts, H., 28  
Abbott, M. M., 86  
Abbud-Madrid, Angel, 46  
Abe, Koki, 142  
Adam, Gina E., 14  
Adams, B. J., 85  
Adams, Paul, 88  
Addy, H. E., 3  
Adebayo, Adefisayo, 141  
Aelst, Linda Van, 130  
Aftosmis, M. J., 71, 149  
Agrawal, Shreekant, 71  
Agrell, Johan, 17  
Albert, Cecilia, 143  
Alfano, Angelo, 42  
Allen, D., 58  
Alshibi, Khalid, 45  
Altman, Amy L., 106  
Anastasiadis, S. H., 80  
Anderson, Bernhard H., 17  
Anderson, Carl W., 112  
Anderson, G. K., 58  
Anderson, Gretchen M., 157  
Anderson, S. W., 174  
Andro, Monty, 65  
Anglos, D., 80  
Archie, Stefanie L., 14  
Archuleta, F. L., 58  
Arey, J., 92  
Arkind, Ken, 10  
Armin, Albert, 17  
Arnaud, M., 168  
Arora, Manish, 142  
Aschenbach, Bernd, 167  
Atencio, J. H., 58  
Atkinson, R., 92  
Audard, M., 28, 75, 168  
Audard, Marc, 167  
Audino, M., 53

## B

Bailey, Paul, 81  
Baker, Gerry, 144  
Bakhru, Hassaram, 159  
Ballard, Jerrell R., Jr., 162  
Ballin, Mark, 11  
Baloga, S., 174  
Baloga, S. M., 180

Banda, Siva S., 74  
Bandara, S. V., 65, 76  
Bannon, Tom, 140  
Barsalou, Norman, 79  
Barsky, Sanford H., 106  
Bartels, Robert E., 2  
Bartelt, Maria, 151  
Bartholomeusz, Richard A., 15  
Bartlett, Rodney J., 40  
Basak, Subhash C., 129  
Bass, Len, 144  
Bau, Robert, 38, 42, 159, 161  
Baust, Henry D., 17  
Baylink, David J., 129  
Beard, Robert, 7  
Beason, Charles, 80  
Beckman, J. R., 86  
Behar, E., 75, 168, 169  
Behar, Ehud, 166, 167  
Beheim, G. M., 75  
Behn, Mark D., 97  
Bell, J., 89  
Bell, J. F., III, 171  
Berg, Martin C., 149  
Berg, Robert F., 74  
Berger, M. J., 149  
Berggren, M., 69  
Berning, Paul R., 51  
Berry, Scott A., 1  
Beyec, Johanne L., 107  
Bibring, Jean-Pierre, 177  
Bierie, Brian, 120  
Biswas, Rupak, 142  
Bixler, J. V., 28  
Bloomberg, Jacob, 124, 125, 134, 135, 136  
Boatz, J. A., 48, 155  
Boatz, Jerry, 55  
Boatz, Jerry A., 39, 41, 42, 43, 48, 56, 57, 58, 59, 60, 151  
Boger, Dan, 144  
Boller, Th., 169  
Bonner, Robert, 174  
Boody, April, 124  
Borges, Carlos, 138  
Borozdin, K. N., 169  
Borrmann, Tobias, 39  
Bourne, Scott, 140  
Boyer, Arthur L., 109  
Boynton, Angela C., 137  
Brand, Adam, 41, 42, 44, 56

Brandon, Jay M., 18  
Branduardi-Raymont, G., 28, 167, 168, 169  
Braunstein, Matthew, 68  
Breitfeller, Eric F., 68  
Brel, Valery K., 34  
Brett, Rube R., 12, 82  
Brinkman, A. C., 28, 168, 169  
Bromage, G. E., 75  
Brown, R. H., 171, 172  
Brown, Susan E., 120  
Brownsword, Lisa, 143  
Brucker, Beth A., 145  
Brundage, Susan I., 108  
Bruno, Claudio, 17  
Buckpitt, A. R., 91  
Buehrle, Ralph D., 150  
Buelow, S. J., 58  
Burant, John, 89  
Burner, A. B., 2  
Bussey, D. B. J., 174  
Bussolino, Luigi, 22  
Byrd, James E., 5

## C

Cabell, Randolph H., 68, 91  
Cahoon, L. B., 93  
Calderwood, David A., 15  
Calero, Monica, 109  
Camphouse, R. C., 74  
Capone, Francis J., 18  
Capozzi, Brian, 10  
Cappi, M., 169  
Carlson, J. J., 148  
Carver, Curtis A., 147  
Casper, J., 2  
Castillo, Anna R., 144  
Caughey, David A., 73  
Censullo, A. C., 90  
Chaffee, Kevin P., 54  
Chalmers, A., 88  
Chambers, Joseph R., 18, 19  
Chambers, Lin, 96  
Champagne, Victor K., 81  
Chang, Chau-Lyan, 70  
Charbonneau, P., 173  
Charles, M. J., 90  
Chatterjee, A., 52  
Chaudhury, Raj, 87



Chen, L., 75  
 Chen, Tien-Chay, 154  
 Cheng, Genhong, 116  
 Cheng, Victor H. L., 8  
 Chernyakin, A. D., 153  
 Chevalier, M., 69  
 Chew, Teng-Leong, 112  
 Chi, X., 3  
 Chiang, J. C., 39  
 Chinitz, W., 17  
 Chirgwin, John M., 121  
 Chona, Ravinder, 84  
 Choo, Yung K., 3  
 Chou, Harrison S. Y., 141  
 Christe, K. O., 48  
 Christe, Karl, 44  
 Christe, Karl O., 34, 38, 39, 40, 42, 43, 48, 56, 57, 60, 159, 161  
 Christon, M. A., 69  
 Chung, Leland W. K., 123  
 Clark, Paul C., 140  
 Clark, R., 176  
 Clavel, J., 169  
 Cler, Daniel L., 4  
 Clifford, S. M., 175  
 Coffey, Neil C., 12, 82  
 Coli, Vincent, 64  
 Collins, Ruth N., 109  
 Collins, William D., 180  
 Connors, Paul, 22  
 Consiglio, Maria, 11  
 Conway, Sheila R., 11  
 Conzen, Suzanne D., 113  
 Cook, Michael, 80  
 Cooper, Bonnie, 170  
 Corbin, Michael V., 162  
 Cordova, France, 167  
 Cork, Michael, 136  
 Cottam, J., 167, 168, 170  
 Cottam, Jean, 167  
 Cox, David E., 68  
 Creighton, Donald J., 119  
 Crommelynck, Dominique, 179  
 Cropper, Mark, 165  
 Cross, Eric, 159  
 Crosslin, Robert, 147  
 Crowell, Harrison P., III, 137  
 Cui, Yongzhi, 120  
 Cunningham, Kevin, 18  
 Curiel, Tyler, 126  
 Czeisler, Charles, 136

## D

D, 158

Dadd, Mike, 81  
 Dalton, Larry D., 53  
 Darmofal, David L., 72  
 Das, Sajal K., 142  
 Davey, Gordon, 81  
 Davies, J. K., 172  
 Davies, Julian A., 117  
 Davis, Darrell W., 52  
 Davis, Larry, 149  
 Day, S. W., 37, 69  
 Dayton, Thomas, 80  
 Deak, Mary A., 141  
 Deardorff, D. Glenn, 173  
 DeBenedictis, Matthew M., 162  
 Delanaye, M., 71  
 DelBalzo, Joseph, 8  
 DeLoach, Richard, 4  
 Delp, Michael, 133  
 DeLucas, Lawrence J., 160  
 denBoggende, A. J., 28  
 denBoggende, A. J. F., 168, 170  
 denHerder, J. W., 28, 168  
 denHerder, J.-W., 168  
 denHerder, Jan Willem, 166  
 Dennerl, Konrad, 167  
 Dennie, Debra, 147  
 DeRose, Michelle E., 42, 43, 156  
 DesJardin, P. E., 69  
 deVries, C. P., 168  
 Dewitte, Steven, 179  
 Dholakia, N., 63  
 Dholakia, R. R., 63  
 DiDuro, John, 147  
 Dingemans, Theo J., 72  
 Dinolt, George W., 139, 140  
 Dixon, David A., 48  
 Dobberpuhl, Stu, 89  
 Dodge, M. C., 92  
 Dols, W. S., 92  
 Donehower, Lawrence A., 105  
 Dones, Luke, 172  
 Doney, S. C., 99  
 Drake, Greg, 41, 42, 44, 56  
 Drake, Greg W., 57  
 Dressler, Rainer A., 47  
 Dryer, David, 62  
 Dryer, David A., 62  
 Dweib, M. A., 52

## E

Eagle, James D., 152  
 Eckert, Kristin A., 121  
 Edmundson, Allen, 125  
 Edwards, Dean P., 126

Ehle, M., 169  
 Ekstroem, U., 158  
 El-Masri, H. A., 129  
 Ellison, S. L., 172  
 Ely, Jay J., 63  
 Ensign, S. H., 93  
 Erard, S., 177  
 Erard, Stephane, 177  
 Erd, C., 168  
 Erzberger, Heinz, 11  
 Eschenko, V. N., 153  
 Euske, Kenneth J., 164  
 Evans, James, 151  
 Evans, Steven W., 23  
 Ewins, D., 18

## F

Fabian, A. C., 166, 168  
 Face, Dean, 64  
 Faeth, Gerard M., 95  
 Fajardo, M. E., 155  
 Fajardo, Mario, 39  
 Fajardo, Mario E., 33, 40, 42, 43, 49, 50, 55, 56, 156  
 Farassat, F., 2  
 Farhat, Jody, 89  
 Farmer, J. D., 177  
 Farrand, William H., 176  
 Fatemi, Mostafa, 104  
 Feher, B. A., 89  
 Fejer, Martin M., 67  
 Fergus, John, 10  
 Ferrando, Arny, 135  
 Ferrando, P., 169  
 Ferrigno, C., 165  
 Feyock, Stefan, 141  
 Fischer, M., 90  
 Fleming, G. G., 6  
 Fleming, Robert, 64  
 Fletcher, Tom, 62  
 Flo, Robert, 146  
 Foley, C. A., 75  
 Fong, Rob, 9  
 Fong, Robert, 7  
 Ford, Steve, 140  
 Forman, Royce G., 84  
 Forrest, Stephen R., 33  
 Forsberg, Flemming, 113  
 Forsley, Lawrence P., 15  
 Forth, Scott C., 84  
 Franchi, Ian A., 97  
 Francis, Gregory, 14  
 Frederick, Robert A., Jr., 12  
 Freyberg, M. J., 169

Fuller, Gerald L., 63  
Fye, Dan, 29

## G

Gabrielson, Edward W., 105  
Gabrion, Jaqueline, 133  
Gainer, Thomas G., 5  
Gannod, Gerald C., 141  
Ganor, Eli, 94  
Gates, T. S., 158  
Gazonas, George A., 36  
Ge, Yi, 142  
Ghai, Manju, 164  
Giannelis, E. P., 80  
Gibbs, Gary P., 68, 91  
Gilbert, Gary R., 126  
Gillespie, J. W., 52  
Glaze, L. S., 180  
Glazel, L. S., 174  
Gonzalez, Guillermo A., 12, 82  
Gordon, Mark S., 58  
Gould, Michael N., 110  
Gourko, V. F., 153  
Goyne, C. P., 37, 69  
Goyne, Christopher P., 37  
Graham, Albert B., 4  
Gratteau, Melinda F., 7  
Graves, S. S., 2  
Green, Bryan D., 173  
Green, R. N., 28  
Green, Rebecca E., 157  
Green, Steve, 11  
Greene, Geoffrey L., 103  
Greguss, Pal, 77  
Griffin, Jerry H., 18  
Griffith, Michelle, 143  
Griffiths, R. Gareth, 167  
Grimm, Sandra L., 117  
Grosveld, Ferdinand W., 150  
Guedel, M., 75, 168, 170  
Gunapala, S. D., 65, 76  
Guo, Bujin, 80

## H

Haberl, Frank, 165  
Hackwell, John, 88  
Haeffelin, M. P. A., 28  
Haftka, Rafael, 16  
Hahn, Joseph M., 170  
Haimes, R., 71  
Hajian, Arsen R., 171  
Hall, Robert M., 19

Hamada, Hozumi, 142  
Hamill, Jonathan T., 148  
Hanel, R. A., 178  
Hansen, G. B., 179  
Hanson, R. K., 79, 157  
Happer, William, 62  
Harding, Thomas H., 137  
Harger, W. P., 92  
Harik, V. M., 158  
Harmer, M. P., 65  
Harper, J., 41, 48, 49  
Hartmann, H. W., 168  
Hasenstein, Karl H., 124  
Hatton, Berry, 111  
Hawkins, D. M., 129  
Hawkins, T. W., 51  
Hawkins, Tom, 41, 42, 56  
Hawkins, Toma, 44  
He, X., 85  
Heffley, Robert K., 13  
Hegge, Joachim, 38  
Heise, J., 168  
Helba, Cynthia, 141  
Hensch, M. J., 3  
Hensch, Michael J., 71  
Henningson, D. S., 69  
Herbert, Brittney-Shea, 131  
Herr, K. C., 178  
Herr, Kenneth, 88  
Hill, Steven M., 107  
Hilsenrath, Ernest, 94, 95  
Hinde, Robert J., 59  
Hinds, Philip W., 102  
Hiraku, Yoichi, 163  
Hitt, M. K., 80  
Hoelz, Derek, 101  
Hogberg, M., 69  
Hoge, B., 48  
Hoge, Berthold, 42  
Holcomb, John B., 108  
Hollis, Brian R., 1  
Holmes, Michael R., 27, 30  
Holstein, Gay, 132  
Holt, K. G., 132  
Holt, Kenneth, 108  
Horvath, Thomas J., 1  
Hoshina, Hiromichi, 33  
Houghton, Martin, 22  
Hu, Yong-Xiang, 96  
Huang, Danhong, 162  
Hummer, Charles R., 51  
Humphreys, Robin, 120  
Hunter, G. W., 75  
Hutchens, Cindy F., 138  
Huyck, C. K., 85

Hwang, Wen-Yen, 80  
Hyde, D. M., 91

## I

Ikebe, Y., 166  
Iliev, Karl J., 32  
Inman, Daniel J., 81  
Inoue, Nozomu, 105  
Irvine, Cynthia E., 139, 140  
Ismail, I. M., 51  
Ismail, Ismail, 56  
Israel, Steven, 156  
Israelevich, Peter, 94  
Ivanov, Mikhail S., 31  
Ivansson, S., 154  
Iwarsson, J., 36

## J

Jacobsen, N., 154  
Jacobsen, Robert, 7  
James, David B., 162  
James, John R., 147  
Janz, Scott, 94, 95  
Jensen, F., 168  
Jernigan, J. G., 168  
Jochum, Markus, 73  
Joensson, M., 154  
John, Bonnie E., 144  
Johnson, J. R., 172  
Jokerst, Nan M., 66  
Jones, D. R., 90  
Jones, Michael G., 1  
Jordan, Robert L., 15  
Joseph, Joachim, 94  
Joshi, Ravindra P., 65  
Jothiprasad, Giridhar, 73  
Joukoff, Alexandre, 179  
Juang, Jer-Nan, 83  
Jung, Paul, 147  
Junghans, Richard P., 130  
Junkins, John L., 83

## K

Kaastra, J. S., 165, 166, 167, 168, 169  
Kadura, Sheila, 118  
Kahn, S. M., 28, 169, 170  
Kahn, Steven M., 76, 166  
Kalich, Melvyn E., 138  
Kannan, Nandini, 122  
Kanner, Howard S., 52  
Karasyuk, V. N., 153

Karlis, H., 158  
 Karma, Alain S., 151  
 Kasevich, Mark, 78  
 Kassaseya, George, 17  
 Kato, Yoshiyasu, 43  
 Katsuki, Hiroyuki, 33  
 Kegerise, Michael A., 68  
 Keim, Eric, 88  
 Keim, Eric R., 178  
 Kelly, B. P., 86  
 Kennedy, Katherine A., 106  
 Kern, Volker, 123  
 Ketsdever, Andrew D., 31  
 Key, David L., 13, 14  
 Khilchenko, A. D., 153  
 Kille, Robert, 7  
 Kim, Hye-Young, 83  
 Kincaid, Rex K., 143  
 Kippelen, Bernard, 54  
 Kirkland, L., 176  
 Kirkland, L. E., 178  
 Kirkland, Laurel, 88  
 Kirsten, Richard, 7  
 Klein, S. R., 161  
 Kleypas, J. A., 99  
 Knerr, Bruce, 152  
 Knuth, Kevin H., 171  
 Kolacinski, Rick, 176  
 Komiyama, Kazuhiko, 163  
 Korkin, Anatoli A., 40  
 Kory, Carol L., 65  
 Kosir, Mary A., 115  
 Kota, Sridhar, 15  
 Krauss, R. H., 37, 69  
 Krishnamurthy, T., 13, 151  
 Krozel, Jimmy, 7  
 Krueger, Ronald, 72  
 Kuipers, Andre, 136  
 Kushner, Cherie, 64  
 Kwon, Young, 82

## L

LaFiandra, M. E., 132  
 LaFiandra, Michael, 108  
 Lalonde, Louise, 155  
 Landis, Mark W., 102  
 Langhoff, P. W., 155  
 Langhoff, Peter W., 59, 151  
 Lapeyre, Gerald J., 155  
 Larson, C. W., 22, 41, 48, 49, 50, 55  
 Lauchle, G. C., 74  
 Laug, Kristi K., 27, 30  
 Leach, Karen E., 155

LeBlanc, Stephen P., 162  
 Lebofsky, L. A., 172  
 LeDue, Patricia A., 14  
 Lee, Michael C., 109  
 Lee, R. B., 28  
 Lee, S. L., 53  
 LeGouic, Marine, 136  
 Leigh, Larry M., 29  
 Lelievre, Sophie A., 115  
 Lessard, Wendy B., 14  
 Lesser, Alan J., 54  
 Leutenegger, M. A., 170  
 Levin, Timothy E., 139, 140  
 Levin, Zev, 94  
 Levison, Harold F., 172  
 Levonen, M., 154  
 Levy, David W., 71  
 Levy, Miguel, 159  
 Lewis, Frances M., 128  
 Li, Sheng S., 39  
 Liao, Shu S., 164  
 Librescu, Liviu, 19  
 Lichtenberg, Chris, 174  
 Lichtenhan, Joseph D., 54  
 Liedahl, D. A., 169  
 Lin, Bing, 96  
 Lin, Chich-Hsiang, 80  
 Lin, Yuan, 74  
 Lincoln, K. A., 79  
 Lindbo, D. L., 85  
 Lindsay, Steve, 27  
 Lindstrom, David J., 97  
 Liu, C. C., 75  
 Liu, C. T., 35, 153  
 Liu, J. K., 65, 76  
 Liu, Jingwen, 101  
 Loeb, N. G., 28  
 Loftin, R. Bowen, 61, 62  
 Loudon, Christopher, 147  
 Lu, James, 72  
 Lu, T. M., 53  
 Lucas, Kenneth W., 126  
 Lucey, P., 176  
 Luck, J. P., 148  
 Luckring, J. M., 2, 3  
 Luettich, R. A., Jr., 100  
 Lukco, D., 75  
 Lumb, D. H., 166  
 Lupu, Ruth, 103  
 Lutfy, Fred M., 31  
 Lyo, S. K., 162

## M

Ma, Chang-Ming, 109  
 Macaitis, Joe M., 108  
 MacKenzie, Wayne, 10  
 MacIer, Michel, 156  
 Madavan, Nateri K., 4  
 Magnuson, Nancy S., 109  
 Mailloux, Robert J., 66, 67  
 Major, Debra, 62  
 Makel, D., 75  
 Malkas, Linda, 101  
 Mallin, M. A., 93  
 Mallon, P. J., 52  
 Manvi, Ramachandra, 176  
 Marinova, M. M., 175  
 Mark, D., 100  
 Markelov, Guenadi N., 31  
 Martin, Elizabeth L., 157  
 Martinez, Richard G., 146  
 Marzocca, Piergiorganni, 19  
 Mason, Brian H., 13  
 Mason, Gregory S., 149  
 Mason, Keith, 167  
 Mather, Patrick T., 54  
 Mavriplis, Dimitri J., 73  
 McAdaragh, Raymon M., 9  
 McCambridge, James, 64  
 McClement, D., 92  
 McCormick, M. P., 98  
 McDaniel, J. C., 37, 69  
 McDaniel, James C., 37  
 McElroy, P., 92  
 McFall, Keith A., 30  
 McGinnis, Michael, 125  
 McGovern, P. J., 175  
 McIver, M. R., 93  
 McKay, Jason B., 78  
 McKay, Milton, 41, 44, 56  
 Mckay, Milton, 42  
 McKinnon, J. Thomas, 46  
 McNelley, Terry R., 82  
 McNesby, Kevin L., 59  
 McPeters, Richard, 95  
 Mead, Franklin B., Jr., 22  
 Medina, Daniel, 101  
 Mekler, Yuri, 94  
 Melkounian, Zaroui, 112  
 Mewe, R., 75, 170  
 Meyer, Maria, 109  
 Meyer, Rodney, 156  
 Miglionico, C. J., 79  
 Miller, T. C., 84  
 Miller, Timothy C., 35, 84  
 Mills, D., 129

Mills, J. D., 57  
 Minguet, Pierre J., 72  
 Minnetyan, Levon, 83  
 Minnis, Patrick, 180  
 Mittaz, J. P. D., 165, 166  
 Mogford, Richard, 11  
 Moldover, Michael R., 74  
 Momose, Takamasa, 33  
 Moren, P., 154  
 Morgan, Matthew L., 97  
 Morgan, Michael A., 138  
 Mori, Kaya, 165  
 Morris, Christina S., 152  
 Morris, Geof F., 12  
 Morrison, Dennis, 125  
 Morrison, J. G., 89  
 Morrison, J. H., 3  
 Motch, Christian, 165  
 Much, Rudu, 167  
 Mukai, A. Y., 100  
 Mukhopadhyay, Vivek, 149  
 Mulder, Kathleen M., 127  
 Mulkern, Thomas J., 53  
 Mundorf, N., 63  
 Mungiole, Michael, 137  
 Muntz, E. P., 31  
 Murchie, S., 176  
 Murchie, Scott L., 77  
 Murr, L. E., 79  
 Mushotzky, F., 166  
 Mushotzky, R. F., 166, 168  
 Mustard, J., 176  
 Mustard, Jack, 96  
 Mustard, John F., 77  
 Myatt, James H., 74

## N

Nanda, S. K., 89  
 Nandiwada, Uday, 64  
 Narita, Masashi, 128  
 Naser, Ahmad S., 13  
 Nemeth, M. P., 158  
 Nemeth, Michael P., 83  
 Nesbitt, Fred L., 176  
 Neudeck, P. G., 75  
 Newell, A. C., 15  
 Newman, James, Jr., 84  
 Newschaffer, Craig J., 114  
 Ng, Cheuk-Yiu, 47  
 Ng, Lawrence C., 68  
 Nielsen, Eric J., 72  
 Nilsson, B., 154  
 Niulsson, M., 51

Nolan, Charles W., II, 139  
 Nooijen, Marcel, 40  
 Noor, Ahmed K., 61, 143  
 Nozette, Stewart, 174

## O

Obusek, J. P., 132  
 Obusek, John P., 108  
 Ojeifo, John O., 119  
 Okojie, R. S., 75  
 Olah, G. A., 48  
 Olah, George A., 38  
 Olsson, R., 35  
 Osborne, Julian, 167  
 Osgood, Richard M., Jr., 159, 161  
 Ottmar, R., 87  
 Owen, Jason E., 102  
 Owens, D. Bruce, 18  
 Owens, L. R., 2  
 Owens, Lewis R., 4

## P

Pachter, Ruth, 58  
 Padgett, Richard W., 114  
 Paerels, F., 166, 167  
 Paerels, F. B. S., 165, 168  
 Paerels, Frits, 165, 168  
 Page, M. J., 169  
 Pandel, Dirk, 167  
 Pappa, Richard S., 150  
 Paradis, Leo R., 162  
 Park, Michael A., 72  
 Park, S., 74  
 Park, Sang-Young, 176  
 Parrott, Tony L., 1  
 Pavlovich, James G., 34  
 Pawlicki, Todd, 109  
 Paxton, James P., 31  
 Pazandak, Paul, 140  
 Pellett, G. L., 17  
 Pelon, J. R., 98  
 Pepi, Marc S., 81  
 Perchonok, Michele, 137  
 Perkins, Leslie S., 50, 58  
 Pesce-Rodriguez, Rose A., 59  
 Pesses, Mark, 156  
 Peterson, J. R., 165, 166, 168  
 Peterson, Laurie J., 137  
 Petschek, Harry E., 27  
 Pettit, R. H., 153  
 Petty, Elizabeth M., 115  
 Peyghambarian, Nasser, 54

Pfaltz, John M., 79  
 Phillips-Angles, Ellen, 128  
 Pierce, Jennifer C., 12  
 Pierson, Duane, 124, 134  
 Pieters, Carle M., 77  
 Pietras, Richard J., 130  
 Pietsch, W., 169  
 Pihl, J. P., 154  
 Pilmanis, Andrew, 122  
 Pinkerton, K. E., 91  
 Piperaki, K., 80  
 Pirzadeh, Shahyar, 71  
 Plassmann, J. H., 171  
 Platzer, Max F., 6  
 Plon, Sharon E., 104  
 Plopper, C. G., 91  
 Polliard, Steven, 146  
 Ponder, Rebecca G., 110  
 Ponman, T. J., 169  
 Ponte, Rui M., 93  
 Poole, L. R., 98  
 Poole, Tracey, 167  
 Pope, Shelly K., 180  
 Porquet, D., 75  
 Powell, John D., 51  
 Prakash, G. K., 48  
 Presby, Tim, 147  
 Presilla-Marquez, J. D., 48  
 Price, Michael J., 156  
 Pridal, Dan, 89  
 Priestley, K. J., 28  
 Pritchard, Joselyn I., 150  
 Proctor, Fred H., 70  
 Psaltis, Demetri, 32  
 Ptak, A., 169  
 Puchnarewicz, E. M., 169  
 Pyle, Barry, 123

## Q

Qian, Wei, 107  
 Quagliaroli, T. M., 37  
 Quick, Dana M., 12

## R

Raassen, A. J. J., 75  
 Rafol, S. B., 65, 76  
 Raftenberg, Martin N., 53  
 Ragsdale, Dan, 147  
 Ragsdale, Daniel J., 147  
 Rajkumar, Raj, 145  
 Raju, I. S., 151  
 Ramaprasad, Subbaraya, 120



Ramsay, Gavin, 165, 167  
 Rash, Clarence E., 14, 137, 138  
 Rasmussen, Andrew, 167  
 Rasmussen, Andrew P., 166, 168  
 Rauw, G., 170  
 Reed, Dave, 123  
 Reheman, C. N., 6  
 Reinig, Karl D., 129  
 Reiprich T. H., 168  
 Reynolds, Barbara S., 138  
 Richardson, Christina E., 79  
 Riedel, Edward P., 46  
 Riegler, Joseph T., 157  
 Rigterink, Paul, 7  
 Rivkin, A. S., 171, 172  
 Rivkin, Andrew, 171  
 Roads, John, 93  
 Roberts, William B., 17  
 Robinson, Mark S., 174  
 Robson, Mark E., 118  
 Rockwell, David, 141  
 Rogers, Walter, 80  
 Rollins, Courtney H., 12, 82  
 Romo-Urbe, Angel, 54  
 Ronney, Paul, 45  
 Roof, C. J., 6  
 Rosen, Jeffrey M., 117  
 Rosen, Richard D., 93  
 Rosenberg, Susan, 110  
 Rostler, Peter S., 31  
 Route, Robert K., 67  
 Rowe, Neil C., 144  
 Roybal, R. E., 79  
 Rudquist, P., 158  
 Ruiz, Abel, 79  
 Rutherford, Malcolm J., 96  
 Rutishauser, David, 3

## S

Sack, Fred, 123  
 Sakelliou, I., 168  
 Sako, M., 169  
 Salisbury, J., 176  
 Salisbury, John, 88  
 Salstein, David A., 93  
 Samulski, Edward T., 72  
 Sazar, Shelley, 118  
 Schafer, Joseph, 147  
 Schenk, Paul, 172, 175  
 Schenk, Paul M., 173  
 Schilling, J. H., 30  
 Schmidt, R. C., 69  
 Schneider, Stefan, 38  
 Schreiber, Martin A., 108

Schroer, Thorsten, 38  
 Schunk, Robert W., 97  
 Schuster, David M., 5  
 Schwab, Joseph J., 54  
 Schwandt, Craig S., 97  
 Schweickart, Randolph, 125  
 Seghal, Chandra, 111  
 Seligman, P. F., 44  
 Selvamanickam, Venkat, 36  
 Semant, Rajeev S., 131  
 Semenova, Irina, 76  
 Seywald, Hans, 176  
 Shapiro, Paul S., 104  
 Sharma, Nandita, 116  
 Shaver, Timothy W., 63  
 Shay, Jerry W., 131  
 Sheehy, J. A., 49, 155  
 Sheehy, Jeff A., 57  
 Sheehy, Jeffery A., 151  
 Sheehy, Jeffrey A., 38, 42, 43, 56, 57, 59, 60, 159, 161  
 SHifflett, David J., 140  
 Shih, T. I.-P., 3  
 Shimski, John T., 52  
 Shott, C. A., 65  
 Shreeve, Raymond P., 6  
 Sielski, Henry, 7  
 Silva, Walter A., 2, 19  
 Simcox, Amanda A., 122  
 Singer, Michael J., 152  
 Singh, A., 39, 76  
 Skaggs, R. W., 85  
 Skoglund, P., 51  
 Slater, J. W., 3  
 Small, D. E., 148  
 Smith, James A., 162  
 Smith, Scott, 134  
 Smith, Steven A., 13  
 Smith, T. M., 69  
 Smith-Bindman, Rebecca, 122  
 Smrekar, S. E., 180  
 Sobieszczanski-Sobieski, Jaroslaw, 143  
 Sobieszczzyk, Steven, 172  
 Sogoshi, Norihito, 43  
 Song, Lin, 128  
 Sorensen, John, 8  
 Spanjers, G. G., 30  
 Spaulding, R. S., 90  
 Spence, Harlan E., 27  
 Spudis, Paul D., 174  
 Squires, Kyle D., 6  
 Sridhar, Banavar, 10  
 St. John, M., 89  
 St.Clair, Terry L., 72  
 Starling, R., 169

Stasinopoulos, A., 80  
 Stein, C., 79  
 Stepinski, T. F., 175  
 Stewart, G., 166  
 Stillwagen, F. H., 176  
 Stodilka, Robert Z., 155  
 Stofan, E. R., 174, 180  
 Strazisar, Anthony J., 17  
 Stroud, W. Jefferson, 13  
 Stuckey, C. Irvin, 52  
 Sture, Stein, 45  
 Suder, Kenneth L., 17  
 Sukumar, Saraswati V., 114  
 Sun, Xuejun, 107  
 Sunkara, Bhaskar, 170  
 Surdu, John R., 147  
 Suri, Suresh C., 50  
 Swango, Beverly E., 137  
 Switzer, George F., 70  
 Sykes, Ruth, 143

## T

Tabiei, Ala, 36  
 Takashima, Naruhisa, 26  
 Tam, Simon, 33, 39, 40, 43, 49, 50, 55, 156  
 Tamura, T., 165, 166  
 Tarr, Ronald W., 152  
 Tawde, Mangale, 112  
 Taylor, B. Douglas, 12, 82  
 Teas, Jane, 116  
 Tham, F., 44  
 Tham, Fook S., 56  
 Thiagarajan, V., 67  
 Thomas, B. E., 33  
 Thomas, Robert J., 79  
 Thomas, V., 75  
 Thompson, Craig, 140  
 Thompson, Donald L., 41  
 Thomsen, K., 28  
 Thor, S. E., 90  
 Thorp, Scott A., 17  
 Thorsen, Michael R., 52  
 Tidriri, M., 150  
 Tidrow, M. Z., 39  
 Tinker, Michael L., 29  
 Tinnirello, Michael, 50  
 Toerne, Mary E., 137  
 Tollison, Kerri, 41, 42, 44  
 Tomanek, David, 159  
 Tomek, W. G., 2  
 Tong, Alex W., 126  
 Tooley, Craig, 22  
 Torquato, Salvatore, 151

Tortorelli, R. L., 86  
 Tracy, Maureen B., 1  
 Treiman, Allan, 88  
 Treiman, Allan H., 97  
 Trevino, Luis, 16  
 Trevino, S. F., 34  
 Trilling, D. E., 171, 172  
 Trudolyubov, S. P., 166  
 Tsubaki, Michiko, 163  
 Tucker, Diane C., 102  
 Tweardy, David J., 108

## U

Ulriksen, P., 154  
 Underwood, Pamela J., 4  
 Urban, David, 45  
 Urban, David L., 95

## V

Valero, Francisco P. J., 180  
 van de Pol, Corins, 138  
 vanderHeyden, K. J., 167  
 vanderHeyden, Kurt, 166  
 Vasques, Marilyn, 123, 132, 133  
 Vassberg, John, 71  
 Vasudevan, Venu, 140  
 Vepraskas, M. J., 85  
 Vesecky, John F., 100  
 Vihnanek, R. E., 87  
 Vij, Ashwani, 34, 38, 39, 42, 44, 56, 60  
 Vij, Vandana, 42, 44, 56  
 Virmani, Arvind K., 127  
 Vittadini, Elena, 137  
 Voth, Gregory, 58  
 Voth, T. E., 69  
 Vrana, Craig A., 157  
 Vreux, J.-M., 170

## W

Wadsworth, Dean C., 31  
 Wagenaar, R. C., 132  
 Wagenaar, Robert, 108  
 Wahlen, B. E., 153  
 Wahls, R. A., 2  
 Wahls, Richard A., 4, 71  
 Waller, Edward, 155  
 Walmerdahl, P., 61  
 Walton, Adam Z., 118  
 Walton, G. N., 92  
 Wang, Qun-Zhen, 29  
 Ward, B., 75

Warren, Mary A., 110  
 Wasfy, Tamer M., 61, 143  
 Watson, Paul G., 39  
 Watson, Willie R., 1  
 Weathered, Brenton W., 12, 82  
 Weathers, Del, 8  
 Webb, James T., 122  
 Wei, Schuang, 126  
 Weiland, Karen J., 45  
 Weinstein, Susan P., 111  
 Weise, D. R., 87  
 Weitz, Catherine, 96  
 Welch, Danny R., 121  
 Wenzel, Brenda M., 144  
 Werling, P., 61  
 Westerink, J. J., 100  
 Westerling, L., 51  
 Westerman, Kurt O., 27  
 Wheatley, Peter, 167  
 Whitson, Peggy, 135  
 Wieder, Robert, 119  
 Wielicki, B. A., 28  
 Wielicki, Bruce, 96  
 Williams, Galbraith D., 15  
 Williams, Susan, 4  
 Wills, M. T., 90  
 Wilmoth, Richard G., 26  
 Wilson, William, 44  
 Wilson, William W., 34, 42, 43, 48, 56, 57, 60  
 Windle, Rose, 141  
 Windover, D., 53  
 Winker, D. M., 98  
 Winkler, G. R., 86  
 Winsborough, William, 145  
 Wintersteiner, Peter P., 98  
 Wolf, Dietrick, 151  
 Wolfe, William J., 145  
 Wong, George Y., 128  
 Wood, Kevin R., 152  
 Woodard, Stanley E., 12, 82  
 Woodman, Keith L., 12, 82  
 Wright, C. S., 87  
 Wu, Huasheng, 155  
 Wuttke, Deborah S., 117  
 Wygnanski, Israel, 16

## X

Xiao, J. J., 63  
 Xiao, Ming Qing, 74  
 Xu, Kuan-Man, 96  
 Xue, Ding, 111

## Y

Yacoob, Yaser, 149  
 Yang, Chonglin, 111  
 Yang, XiaoHe, 102  
 Yoo, Hi Young, 55  
 Young, Sandra K., 34  
 Young, Stephen J., 78  
 Yu, Mickey, 155

## Z

Zahnle, Kevin, 172  
 Zakharov, V. E., 15  
 Zane, Silvia, 165  
 Zavlin, Vyacheslav E., 165  
 Zeng, L., 35  
 Zetocha, Paul, 27  
 Zhang, Xiao-kun, 111  
 Zhang, Xiongzi, 38, 42, 159, 161  
 Zhou, Wei-Jia, 125  
 Zhu, B., 3  
 Ziaee, S., 52  
 Zickuhr, Tom, 71  
 Zimmerli, Gregory A., 74  
 Zirino, A., 44  
 Zook, Herbert A., 170  
 Zube, Dieter M., 29